PHASE 1 - FINAL REPORT ON SOIL INTERIM REMEDIAL ACTION

ON-SITE LANDFILL GRENADA, MISSISSIPPI

Prepared for:

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September 1993

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October 11, 1993 9124

Mr. Tony Russell
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Bureau of Pollution Control
Mississippi Department of Environmental Quality
P.O. Box 10385
Jackson, MS 39289-0385

RE: Soil Interim Remedial Action
On-Site Landfill, Grenada, Mississippi

Dear Mr. Russell:

Please find attached the report on Phase I evaluations regarding the Soil Interim Remedial Action planned for the On-Site Landfill at the Randall Textron property. This compilation of Phase I study results has been prepared and is being submitted to the Mississippi Department of Environmental Quality (MDEQ) at the request of Rockwell International Corporation (Rockwell) pursuant to discussions which occurred at a meeting held in the MDEQ office on August 17, 1993.

Overall, the treatability test results were very encouraging. Preliminary evaluations suggest that remedial costs using the technology evaluated, ex situ soil vapor extraction, could be as little as one-tenth of the cost of conventional off site treatment and disposal methods.

Rockwell plans to proceed with Phase II, Engineering Design and Implementation, of this interim action in the near future and, therefore, would like to receive agency comments as soon as possible. Hopefully, most comments can be addressed at the meeting on Friday, October 15, 1993.

Sincerely,

ECKENFELDER INC.®

Gary W. Martin, P.E., CHMM
Senior Manager
Waste Management Division

cc: Phil Backlund
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Robert D. Norris, Ph.D.

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EXECUTIVE SUMMARY

Rockwell International (Rockwell) is currently conducting a Remedial Investigation/Feasibility Study (RI/FS) for the on-site landfill located at the Randall Textron plant in Grenada, Mississippi. Through the investigation of the various environmental media associated or potentially impacted by the on-site landfill it was determined that high concentrations of several organic constituents, particularly TCE, were present in the shallow soils in this area. Based on the evaluation of analytical results for TCE, it became apparent that an interim remedial measure may be appropriate for shallow site soils in the vicinity of the on-site landfill. An initial assessment of potential remedial technologies for TCE-containing soils was then performed.

Based upon site characteristics and chemical properties, the use of ex situ vapor stripping was identified as a potentially cost-effective technology for use in an interim remedial action. ECKENFELDER INC. then developed a two-phased approach for the development and implementation of an interim remedial action. Phase I of this effort consisted of the derivation of interim cleanup levels, the conduct of a focused treatability study and the engineering evaluation of the concept. Phase II includes the preparation of the implementation plan, including plans and specifications, and remedial construction activities. Phase I has been completed and the results are the focus of the report. Phase II work is scheduled to begin in the near future.

The results presented herein on the development of an interim remedial action were discussed in a recent meeting with the Mississippi Department of Environmental Quality (MDEQ). Two key issues with respect to this project were raised. First, the MDEQ stated that, in all likelihood, future environmental planning and investigations would be conducted under the USEPA RCRA regulatory framework. Until now, the on site landfill has been managed under the state Superfund program. Second, it was decided that the results of Phase I evaluations for the interim remedial action would be compiled and presented to the MDEQ for review. The compiled results of Phase I results are presented in Sections 2-4 of this report. In addition, the MDEQ pointed out that protection of groundwater should be considered in the development and implementation of the interim remedial action. This evaluation was performed and is included in Section 5. With the

understanding that this project is ready to proceed to Phase II, Rockwell submits this Phase I report and would like to discuss any agency comments as soon as possible. Rockwell anticipates preparing the interim remedial action plan (plans and specifications) and initiating implementation within approximately 2 months after appropriate agency concurrence with the findings of this Phase I report.

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Jerry B.

F001, F002
or U228

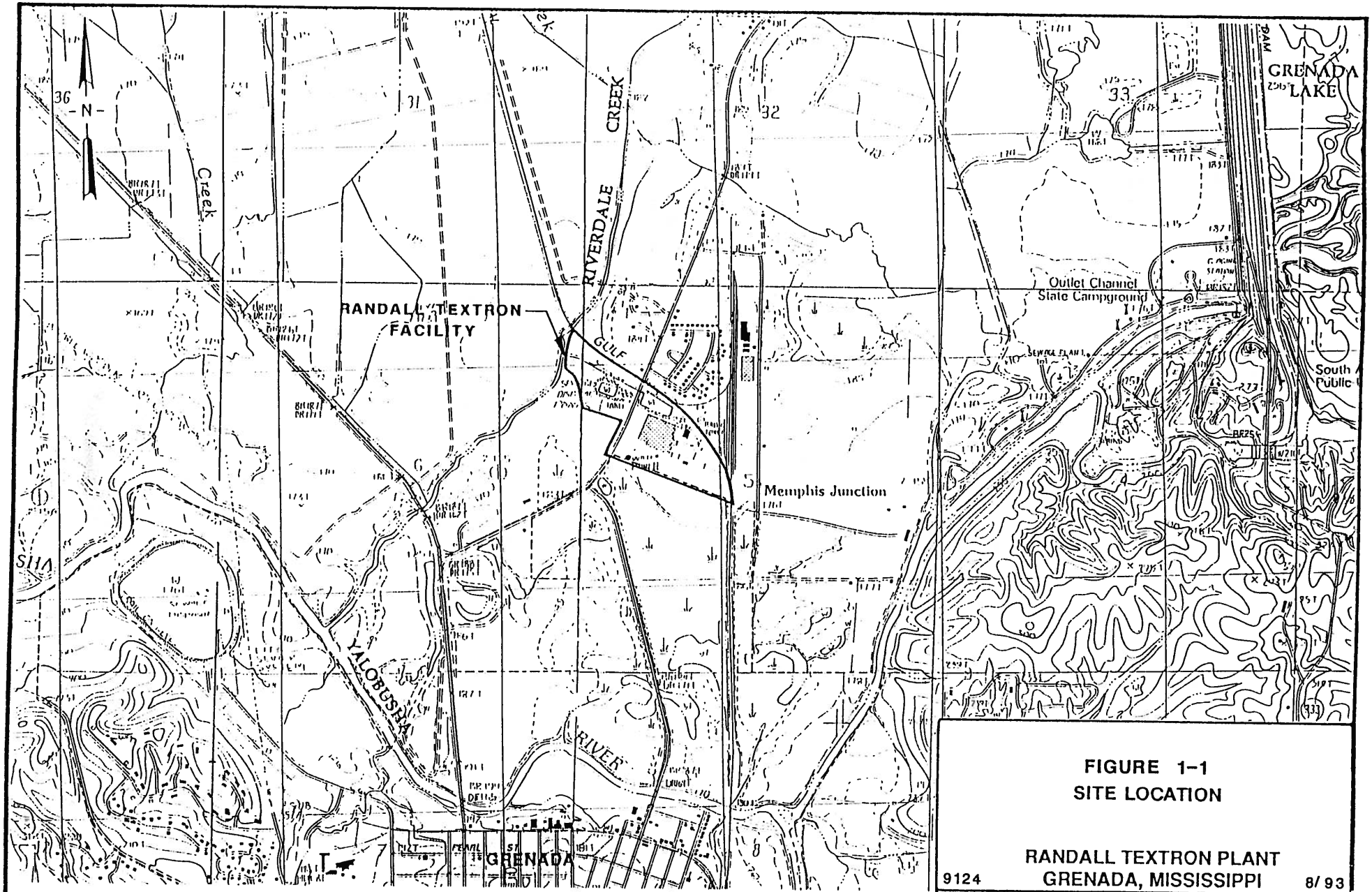
1.0 INTRODUCTION

Rockwell International is currently conducting a Remedial Investigation/Feasibility Study (RI/FS) for the on-site landfill located at the Randall Textron plant in Grenada, Mississippi. The facility is located approximately 1.5 miles north of Grenada as shown by the general site location map presented in Figure 1-1. Rockwell International operated the plant from 1966 to July 1985. During the period from 1961 to 1967, the area designated as the on-site landfill was used by the plant for final disposal of waste generated from plant processes (see Figure 1-2). The wastes are reported to have potentially included buffing compounds, still bottoms from trichloroethylene (TCE) recovery operations, and paint sludges. The RI/FS is being conducted under Administrative Order No. 1859-90, issued by the Mississippi Department of Environmental Quality (MDEQ).

Based on soil sampling/analysis conducted as part of the RI/FS an interim remedial measure appears to be appropriate for site soils in the vicinity of the on-site landfill. High concentrations of several organic constituents (particularly TCE) have been detected in shallow soils collected from 0 to 8 feet below ground surface in this area. As stated in the MDEQ's Guidance for Remediation of Uncontrolled Hazardous Substance Sites in Mississippi (MDEQ Guidance; MDEQ, August 1990), interim remedial actions may be necessary due to the "presence of high concentrations of hazardous substances in soils largely at or near the surface that may migrate readily to receptors, or to which the public may be inadvertently or unknowingly exposed."

Apart from some immediate justification for interim remediation, an interim action can serve as a "proving ground" for other, subsequent (final) remedial actions; offers removal of chemical mass, sometimes reducing the baseline risk estimate prior to the FS or final actions; and is most often unencumbered by the formality associated with the selection and implementation of final remedial decisions. On the other hand, Rockwell recognizes that at the Grenada site a soil interim action probably will not significantly reduce the concentration of TCE in groundwater beneath the site.

ECKENFELDER INC. has performed an initial assessment of potential remedial actions for the TCE-containing soils adjacent to the on-site landfill. Based upon site



Modified from U.S.G.S., Grenada, Mississippi Quadrangle, 1983

FIGURE 1-1
SITE LOCATION

RANDALL TEXTRON PLANT
9124 **GRENADA, MISSISSIPPI** 8/93

ECKENFELDER INC. Nashville, Tennessee; Mahwah, New Jersey

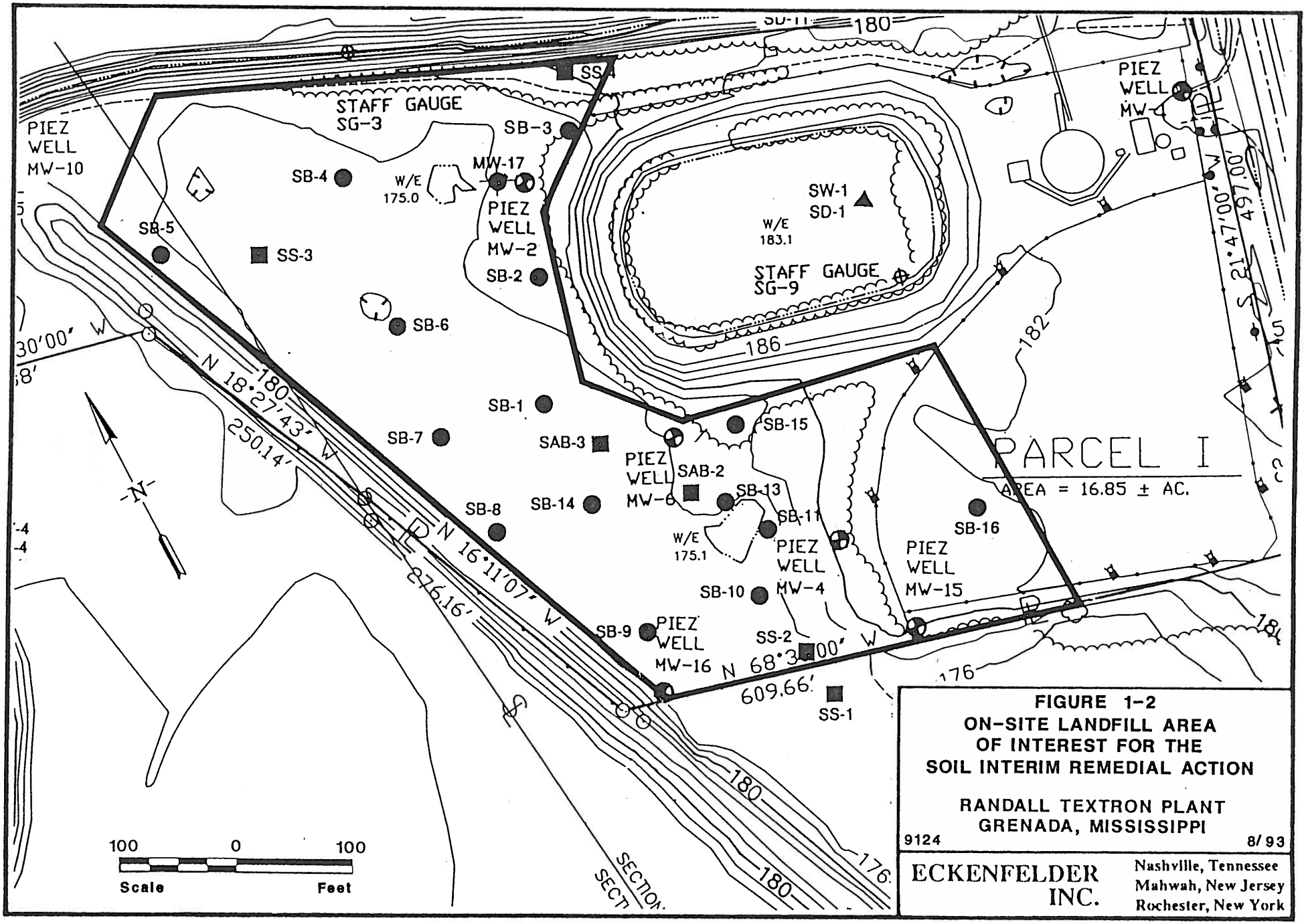


FIGURE 1-2
ON-SITE LANDFILL AREA OF INTEREST FOR THE SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT
GRENADA, MISSISSIPPI

9124 8/93

ECKENFELDER INC.
Nashville, Tennessee
Mahwah, New Jersey
Rochester, New York

characteristics and chemical properties, several innovative technologies (which are often cost-effective) do not appear feasible, such as in situ vapor stripping and/or sparging, soil washing, bioremediation, etc. Thermal desorption, another innovative technology, may be suitable for larger volumes and longer term remedial activities. Conventional technologies, such as incineration and off-site landfill disposal, are extremely expensive. One option which has been identified as potentially cost-effective is ex situ vapor stripping (either in a soil cell or by tilling of surficial soils).

To determine the technical approach, the method of implementation, and potential effectiveness of an interim remedial action the following three tasks were conducted.

- Derivation of Interim clean-up levels
- Treatability Study
- Engineering Evaluation

These three tasks constituted the Phase I effort of the soil interim action. The methodology and output of each task are presented in this report.

2.0 DERIVATION OF INTERIM CLEANUP LEVELS

Methodologies by which to derive interim target cleanup levels are available in both the Mississippi Department of Environmental Quality (MDEQ) guidance entitled "Guidance for Remediation of Uncontrolled Hazardous Substance Sites in Mississippi" (MDEQ, 1990) and in USEPA's *Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual, Part B, Development of Risk-based Preliminary Remediation Goals* (USEPA Part B Guidance; USEPA, 1991a). Both methodologies were utilized in the determination of a range of interim target cleanup levels to address the presence of the organic constituents in the on-site soils. The following is a discussion on the development and evaluation of interim target clean-up levels.

2.1 SUMMARY OF CONSTITUENTS OF INTEREST

Analytical data for the shallow soil samples collected during the Remedial Investigation (RI) from depths of 0 to 8 feet in the vicinity of the on-site landfill were evaluated to determine the organic constituents of interest. As discussed later, potential exposure to soils is not believed to occur at depths greater than 8 feet. A list of the RI soil samples that are relevant to this interim remedial action (i.e., those directly associated with the on-site landfill) is presented in Table 2-1; soil sample locations are indicated on Figure 1-2. A summary of the analytical data for these soil samples is presented in Appendix A.

In order to determine constituents of interest in shallow soils associated with the on-site landfill, the analytical data were evaluated in terms of comparison to background and comparison to concentrations in laboratory and field blanks. Because the organic constituents of possible interest here are generally not expected to be present in soils under naturally-occurring conditions, the background concentration of any organic constituent was assumed to be nondetect (ND), and therefore, any organic constituent detected in these soil samples was considered as a potential constituent of interest. There were no pesticides or PCBs detected in the soil samples; therefore, pesticides and PCBs were not retained as constituents of interest.

TABLE 2-1

SOIL SAMPLES OF INTEREST FOR THE ON-SITE LANDFILL[a]
SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT
GRENADA, MISSISSIPPI

Laboratory Sample No.	Field Identification	Sample Depth (ft)
5146	SAB-2 duplicate	0-0.5
5147	SAB-2	0-0.5
5148	SAB-3	0-0.5
9066	SS-2	0-0.5
9067	SS-3	0-0.5
9068	SS-4	0-0.5
9070	SS-4 duplicate	0-0.5
9168	MW-16	0-0.5
9169	MW-16	2-4
9170	MW-16	6-8
9171	MW-15	0-0.5
9172	MW-15	2-4
9173	MW-15	6-8
0164	SB-1	0-0.5
0165	SB-1	2-4
0166	SB-1	6-8
0167	SB-2	0-0.5
0168	SB-2	2-4
0169	SB-2	6-8
0170	SB-3	0-0.5
0171	SB-3	2-4
0172	SB-3	6-8
0173	SB-4	0-0.5
0174	SB-4	2-4
0175	SB-4	6-8
0176	SB-4 duplicate	0-0.5
0177	SB-5	0-0.5
0178	SB-5	2-4
0179	SB-5	6-8
0180	SB-6	0-0.5
0181	SB-6	2-4
0182	SB-6	6-8
0294	SB-7	0-0.5
0295	SB-7	2-4
0296	SB-7	6-8
0297	SB-8	0-0.5
0298	SB-8	2-4
0299	SB-8	6-8
0300	SB-9	0-0.5
0301	SB-9	2-4

TABLE 2-1 (Continued)

SOIL SAMPLES OF INTEREST FOR THE ON-SITE LANDFILL[a]
SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT
GRENADA, MISSISSIPPI

Laboratory Sample No.	Field Identification	Sample Depth (ft)
0302	SB-9	6-8
0303	SB-8 duplicate	0-0.5
0306	SB-10	0-0.5
0307	SB-10	2-4
0308	SB-10	6-8
0309	SB-11	0-0.5
0310	SB-11	2-4
0312	SB-12	0-0.5
0313	SB-12	2-4
0314	SB-12	6-8
0316	SB-13	0-0.5
0317	SB-13	2-4
0318	SB-13	6-8
0319	SB-14	0-0.5
0320	SB-14	2-4
0321	SB-14	6-8
0322	SB-15	0-0.5
0323	SB-15	2-4
0324	SB-15	6-8
0325	SB-16	0-0.5
0326	SB-16	2-4
0327	SB-16	6-8
0328	SB-16 duplicate	0-0.5

[a]There is a total of 63 samples which represent locations related to the Interim Remedial Action and include samples obtained from the 0 to 8 ft depth interval. Sample locations are shown on Figure 1-2.

Data for all detected organic constituents for the on-site soil samples of interest (per Table 2-1) were evaluated with respect to potential contamination due to laboratory, transportation, or field procedures. Any constituents associated exclusively with blanks or laboratory contamination (i.e., constituents for which all detections were X-qualified, as discussed below) were not retained as constituents of interest. Trip blanks and field blanks for the on-site soil samples were only used for a qualitative evaluation of contamination as these blanks were aqueous samples and were analyzed using different methods than soil samples. However, a quantitative evaluation of on-site soil samples with respect to method blank concentrations (an evaluation of potential contamination due to laboratory procedures) was conducted.

Soil sample data were compared to method blank data in accordance with guidelines set forth in *Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual, Part A,* (USEPA Part A Guidance; USEPA, 1989a) and in *Guidance for Data Useability in Risk Assessment (Part A)* (USEPA, 1992e). For method blanks containing "common" laboratory contaminants (i.e., acetone, 2-butanone, methylene chloride, toluene, and phthalate esters), the analytical data were evaluated using the "ten times" rule. That is, a sample result was considered positive only if it exceeded ten times the maximum concentration in the associated method blank. If the sample concentration was less than ten times that of the associated blank, then the sample was considered to have a nondetect result for that constituent and has been qualified with an "X" in Appendix A. For blanks containing "uncommon" laboratory contaminants (e.g., any contaminant detected in the method blanks other than those listed above), sample results were evaluated using the "five times" rule. A sample result was considered positive only if the concentration exceeded five times the maximum detection in the associated method blank. Samples with concentrations less than five times that of the associated blanks were considered to be nondetect for that constituent, and have been qualified with an "X" in Appendix A.

Analytical results for samples which had been diluted in the laboratory were reported as the diluted sample concentration multiplied by the dilution factor. For the quantitative method blank evaluation of such samples, the diluted sample concentration was compared to that of the associated method blank (i.e., the reported value divided by the dilution factor). The diluted sample concentrations were also evaluated using the five and ten times rules, as appropriate.

Data qualified with a "B" indicate that the parameter was also found in an associated blank, either a laboratory blank or a field or transportation blank, which is an indication that the detection may be suspect. All data that were less than ten times (for common contaminants) or five times (for uncommon contaminants) the blank concentrations were B-qualified, and were additionally qualified with an "X" to indicate that the results were considered nondetects (see Appendix A).

The evaluation of the analytical data for the on-site soils resulted in several detections of organic constituents which could be eliminated on the basis of the comparison to method blank concentrations. With respect to the semivolatile constituents detected in on-site soil samples, two constituents, bis(2-ethylhexyl)phthalate and di-n-butyl phthalate, were not retained as constituents of interest on the basis of this comparison because all detections were X-qualified. There were no trip blanks or field blanks associated with the semivolatile analytical results.

The evaluation of volatile organic data for the on-site soils also resulted in several detections which could be eliminated on the basis of comparison to method blank concentrations. Five detections of methylene chloride, two detections of acetone, two detections of TCE, and seven detections of toluene were considered as nondetects (i.e., X-qualified), based on this comparison. However, no volatile organic constituent was completely eliminated from interest on the basis of the method blank evaluation. It should be noted that constituents were also detected in some of the trip blanks and field blanks associated with the soil samples analyzed for volatile organics. Most of the concentrations were low (i.e., less than 0.005 mg/L), however there were two relatively high concentrations of particular note: a detection of 0.060 mg/L of acetone in Field Blank #2 (sample No. 0185) and a detection of 0.048 mg/L of TCE in Field Blank #1 (sample No. 0183). However, acetone and TCE have been detected in much greater concentrations in the soil samples of interest (e.g., maximum concentrations of 20 mg/kg and 5,400 mg/kg respectively; see Table 2-2), and are retained as constituents of interest in the on-site soil samples.

Based on the comparison of the shallow soil (0 to 8 feet) sample concentrations to the concentrations of constituents detected in the method blanks, field blanks, and trip

TABLE 2-2

ORGANIC CONSTITUENTS OF INTEREST IN ON-SITE SOILS[a]
SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT
GRENADA, MISSISSIPPI

Constituent	Range of Detection[b] (mg/kg)
Acetone	0.035-20
2-Butanone	0.032-0.37
Chloroform	0.0033-0.0099
Chloromethane	0.095
1,2-Dichloroethene (total)	0.0034-64
Ethyl benzene	0.0063-17
2-Hexanone	0.019
Methylene chloride	0.33
2-Methylnaphthalene	3.6-6.5
4-Methyl-2-pentanone	0.0052-0.025
Naphthalene	2-3.6
1,1,2,2-Tetrachloroethane	0.0034-0.87
Tetrachloroethene	0.002-5.9
Toluene	0.0031-84
1,1,2-Trichloroethane	0.03-2.3
Trichloroethene	0.0042-5,400
Xylene (total)	0.0032-93

[a]On-site soil samples of interest are listed in Table 2-1.
[b]Measured concentrations of volatile organics have been converted from μg/kg to mg/kg.

blanks, there are 17 final constituents of interest. These constituents are presented in Table 2-2 along with the range of detection of the constituents for the relevant on-site soil samples.

2.2 POTENTIAL EXPOSURE ROUTES AND POPULATIONS

Methodologies by which to derive target levels are available in both the MDEQ Guidance (MDEQ, 1990), and in the USEPA Part B Guidance (USEPA, 1991a). The MDEQ Guidance method for deriving target cleanup levels utilizes standard, default (i.e., not site-specific) exposure parameters and assumptions; however, provisions are given so that target levels may be proposed based on site-specific exposure information. The USEPA Part B Guidance primarily utilizes site-specific exposure parameters and assumptions. Therefore, a range of target levels will be derived for organic constituents in site soils near the on-site landfill using both the MDEQ Guidance and USEPA Part B Guidance methodologies. However, evaluation of potential future site uses is not considered relevant to the derivation of target levels for interim remedial measures.

2.2.1 MDEQ Guidance

The MDEQ method of determining interim target cleanup levels does not require the selection of a potentially exposed population, because default exposure parameters are presented for use in the MDEQ equations. Because default exposure parameters were only available in the MDEQ guidance for the incidental ingestion of soil exposure route, this route was selected for evaluation.

The equations and exposure parameters used in the determination of interim target clean-up levels associated with the incidental soil ingestion route using the MDEQ method for carcinogens and noncarcinogens are presented in Tables 2-3 and 2-4, respectively. As noted in Table 2-3, interim target cleanup levels determined for carcinogenic constituents incorporate exposure parameters representing an adult exposure only, (i.e., a 70 kg body weight and a 0.1 g/day ingestion rate). The MDEQ Guidance notes this is because the current USEPA model used in cancer risk assessments considers carcinogenic effects to be an expression of cumulative dose, and assumes that high exposure during childhood alone is not significant in determining lifetime cancer risk (MDEQ, 1990). The MDEQ method for determining

TABLE 2-3

MDEQ METHOD FOR EVALUATING INCIDENTAL INGESTION OF SOIL (CARCINOGENS)[a]
SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT
GRENADA, MISSISSIPPI

$$\text{Interim Target Cleanup Level for Carcinogens (mg/kg)} = \frac{R \times W \times CF^{b}}{q^{*} \times I}$$

Variable	Value	Remarks
R	10^{-6} Class A and B; 10^{-5} Class C	Specified target risk levels for classes of carcinogens
W	70 kg	Specified adult body weight
CF^{b}	1000 g/kg	Conversion factor to obtain interim target cleanup level in units of mg/kg
q^{*}	Chemical-specific $(mg/kg\text{-}day)^{-1}$	Slope factor obtained from IRIS or HEAST
I	0.1 g/day	Specified soil ingestion rate

[a]MDEQ, 1990. Target cleanup levels per the carcinogenic incidental soil ingestion equation address adult populations only.

[b]The conversion factor has been added to the MDEQ equation to obtain an interim target cleanup level in units of mg/kg rather than mg/g.

TABLE 2-4

MDEQ METHOD FOR EVALUATING INCIDENTAL INGESTION OF SOIL (NONCARCINOGENS)[a]
SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT
GRENADA, MISSISSIPPI

$$\text{Interim Target Cleanup Level for Noncarcinogens (mg/kg)} = \frac{\text{RfD} \times \text{W} \times \text{CF}^{b}}{\text{I}}$$

Variable	Value	Remarks
RfD	Chemical-specific (mg/kg-day)	Reference dose obtained from IRIS or HEAST
W	16 kg	Specified child body weight
CF^b	1000 g/kg	Conversion factor to obtain interim target cleanup level in units of mg/kg
I	0.2 g/day	Specified soil ingestion rate

[a]MDEQ, 1990. Target cleanup levels per the noncarcinogenic incidental soil ingestion equation address child populations only.

[b]The conversion factor has been added to the MDEQ equation to obtain an interim target cleanup level in units of mg/kg rather than mg/g.

interim target cleanup levels associated with systemic toxicants (i.e., for noncarcinogenic effects) utilizes parameters for a child exposure only, (i.e., a body weight of 16 kg and an ingestion rate of 0.2 g/day). The MDEQ Guidance notes that child exposure parameters are used for the noncarcinogenic incidental soil ingestion equation because children have the greatest tendency to ingest soil (MDEQ, 1990). Therefore, a scenario for soil ingestion with an adult population was not evaluated for potential noncarcinogenic effects and it is believed that a soil ingestion scenario for a child population represents the worst case exposure scenario.

2.2.2 USEPA Part B Guidance

Interim target clean-up levels determined using the USEPA Part B Guidance (USEPA, 1991a) were based on two different potential exposure scenarios: a recreational/trespasser population and a maintenance worker population. Knowledge of site-specific conditions associated with the area in question was used to determine the exposure scenarios. On a regular basis, the on-site landfill area is not accessed by any population; residences are not currently present on the site. However, residential areas are located in the immediate vicinity of the site (within approximately 1,000 ft of the on-site landfill) and people do trespass onto this property, possibly for hunting purposes or to use the baseball field. It was determined that such a population may be exposed through incidental ingestion and dermal contact with the surficial soils (0-0.5 feet) present in the on-site landfill area (see Figure 1) during such activities.

It seems reasonable, based upon the presence of the residential neighborhood in the immediate vicinity of the site, that both adults and children would be represented by the recreational/trespasser population. Because body weight, soil ingestion rate, body surface area, and exposure duration may vary substantially for adults and children, age-adjusted exposure parameters were used to estimate potential exposures for the recreational/trespasser population. The age-adjusted exposure parameters are presented in Tables 2-5 and 2-6. Interim target cleanup level equations and exposure parameters used for the recreational/trespasser population are presented in Table 2-7 and further discussed below.

TABLE 2-5

USEPA PART B METHOD FOR INCIDENTAL SOIL INGESTION FOR THE RECREATIONAL/TRESPASSER CHILD/ADULT POPULATION[a] SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT GRENADA, MISSISSIPPI

$$IF\ (mg/kg) = \frac{IR_{child} \times EF_{child} \times ED_{child}}{BW_{child}} + \frac{IR_{adult} \times EF_{adult} \times ED_{adult}}{BW_{adult}}$$

			Remarks/Source
IF	=	Age-adjusted Incidental Soil Ingestion Factor = 2,681 mg/kg	--
IR_{child}	=	Child Incidental Ingestion Rate = 100 mg soil/day	Rate for 7-18 year olds; assumed same as adult incidental ingestion rate (USEPA, 1991a)
EF_{child}	=	Child Exposure Frequency = 50 days/year	One day per week (professional judgment); 50 weeks per year (USEPA, 1991b)
ED_{child}	=	Child Exposure Duration = 12 years	Ages 7-18 (or 12 years; based on professional judgment); combined with the adult exposure duration yields a 30 year residence at one location (USEPA, 1991a; USEPA, 1991b)
BW_{child}	=	Child Body Weight = 43 kg	Average (50th percentile) for male and female children ages 7-18 (USEPA, 1989b).
IR_{adult}	=	Adult Incidental Ingestion Rate = 100 mg soil/day	USEPA, 1991a; USEPA, 1991b; MDEQ, 1990
EF_{adult}	=	Adult Exposure Frequency = 50 days/year	One day per week (professional judgment); 50 weeks per year (USEPA, 1991b)
ED_{adult}	=	Adult Exposure Duration = 18 years	Ages 19-36 (or 18 years; based on professional judgment); combined with the child exposure duration yields a 30 year residence at one location (USEPA, 1991a; USEPA, 1991b)
BW_{adult}	=	Adult Body Weight = 70 kg	USEPA, 1991a; USEPA, 1991b; MDEQ, 1990

[a]It was not believed reasonable to assume that children ages 1 to 6 would be likely to access the on-site landfill.

TABLE 2-6

USEPA PART B METHOD FOR DERMAL CONTACT WITH SOIL FOR THE RECREATIONAL/TRESPASSER CHILD/ADULT POPULATION[a] SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT GRENADA, MISSISSIPPI

$$DF\ (cm^2/kg) = \frac{SA_{child} \times EF_{child} \times ED_{child}}{BW_{child}} + \frac{SA_{adult} \times EF_{adult} \times ED_{adult}}{BW_{adult}}$$

			Remark/Source
DF	=	Age-adjusted Dermal Contact with Soil Factor = 121,734 cm^2/kg	--
SA_{child}	=	Child Skin Surface Area Available for Contact = 3,380 cm^2/day	25% of child (ages 7-18) total body area (USEPA, 1992a)
EF_{child}	=	Child Exposure Frequency = 50 days/year	One day per week (professional judgment); 50 weeks per year (USEPA, 1991b)
ED_{child}	=	Child Exposure Duration = 12 years	Ages 7-18 (or 12 years; based on professional judgment); combined with the adult exposure duration yields a 30 year residence at one location (USEPA, 1991; USEPA, 199b)
BW_{child}	=	Child Body Weight = 43 kg	Average (50th percentile) for male and female children ages 7-18 (USEPA, 1989b)
SA_{adult}	=	Adult Skin Surface Area Available for Contact = 5,800 cm^2/day	25% of adult total body area (USEPA, 1992a)
EF_{adult}	=	Adult Exposure Frequency = 50 days/year	One day per week (professional judgment); 50 weeks per year (USEPA, 1991b)
ED_{adult}	=	Adult Exposure Duration = 18 years	Ages 19-36 (or 18 years; based on professional judgment); combined with the child exposure duration yields a 30 year residence at one location (USEPA, 1991a; USEPA, 1991b)
BW_{adult}	=	Adult Body Weight = 70 kg	USEPA, 1991a; USEPA, 1991b; MDEQ, 1990

[a]It was not believed reasonable to assume that children ages 1 to 6 would be likely to access the on-site landfill.

TABLE 2-7

USEPA PART B METHOD FOR CALCULATING INTERIM TARGET CLEANUP LEVELS FOR THE RECREATIONAL/TRESPASSER POPULATION[a] SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT GRENADA, MISSISSIPPI

$$CS_C = \frac{TR \times AT}{SF \times CF \times [(DF \times AF \times ABS) + (IF \times FI)]}$$

(Carcinogens)

			Remarks/Source
CS_C	=	Interim target cleanup level (carcinogenic effects; mg/kg)	--
TR	=	Target risk level (10^{-6} for Class A, B, and C)	All carcinogens evaluated at a 10^{-6} risk level (USEPA, 1991a)
AT	=	Averaging time (25,550 days)	Averaging time for carcinogens is 70 years times 365 days per year (i.e., 25,550 days) (USEPA, 1991a)
SF	=	Chemical-specific oral slope factor $(mg/kg\text{-}day)^{-1}$	USEPA-recommended toxicity information obtained from IRIS/HEAST (see Table 9)
CF	=	Conversion factor (10^{-6} kg/mg)	USEPA, 1991a
DF	=	Age-adjusted dermal contact with soil factor (121,734 cm^2/kg)	See Table 5
AF	=	Soil to skin adherence factor (1 mg/cm^2)	Recommended default upper-bound value (USEPA, 1992a)
ABS	=	Absorption factor (1% for organics)	USEPA Region IV guidance (1992a)
IF	=	Age-adjusted soil ingestion factor (2,681 mg/kg)	See Table 5
FI	=	Fraction ingested from contaminated source (1.0)	Recommended default value (USEPA, 1989a)

TABLE 2-7 (Continued)

USEPA PART B METHOD FOR CALCULATING INTERIM TARGET CLEANUP LEVELS FOR THE RECREATIONAL/TRESPASSER POPULATION[a] SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT GRENADA, MISSISSIPPI

$$CS_{NC} = \frac{THI \times RfD \times AT}{CF \times [(DF \times AF \times ABS) + (IF \times FI)]}$$

(Noncarcinogens)

			Remarks/Source
CS_{NC}	=	Interim target cleanup level (noncarcinogenic effects; mg/kg)	--
THI	=	Target hazard index (1.0)	Noncarcinogens evaluated at the USEPA's "acceptable" limit of 1.0 (USEPA, 1991a)
AT	=	Averaging time (10,950 days)	Averaging time for noncarcinogens is 30 years times 365 days per year (i.e., 10,950 days) (USEPA, 1991a)
RfD	=	Chemical-specific oral reference dose (mg/kg-day)	USEPA-recommended toxicity information obtained from IRIS/HEAST (see Table 9)
CF	=	Conversion factor (10^{-6} kg/mg)	USEPA, 1991a
DF	=	Age-adjusted dermal contact with soil factor (121,734 cm^2/kg)	See Table 5
AF	=	Soil to skin adherence factor (1.0 mg/cm^2)	Recommended default upper-bound value (USEPA, 1992a)
ABS	=	Absorption factor (1% organics)	USEPA Region IV guidance (1992a)
IF	=	Age-adjusted soil ingestion factor (2,681 mg/kg)	See Table 5
FI	=	Fraction ingested from contaminated source (1.0)	Recommended default value (USEPA, 1989a)

[a]Includes age-adjusted factors and represents child (ages 7 to 18) and adults (ages 19 to 36) for incidental ingestion and dermal contact with surficial soil.

2.2.3 Recreational/Trespasser Population

For the recreational/trespasser population, professional judgment was used in determining the exposure duration and exposure frequency to be used in the determination of the interim target cleanup levels. The age-adjusted approach utilized for the recreational/trespasser child/adult population combines a child exposure from the ages of 7 to 18 (a 12 year exposure duration) (ED) with an adult exposure from ages 19 to 36 (an 18 year exposure duration) for a total exposure duration of 30 years, which represents the national upperbound 90th percentile for length of stay at one residence (USEPA, 1989a). It was not believed reasonable to assume that children ages 1-6 would be likely to access the on-site landfill area. With respect to exposure frequency (EF), it was assumed that the recreational/trespasser child/adult population would potentially access the site on the average of 1 day per week for 50 weeks of the year. As is recommended in the current USEPA guidance (USEPA, 1991a; USEPA, 1991b), it was assumed that two weeks per year were <u>not</u> spent in the local area.

2.2.4 Occupational Maintenance Worker Population

In addition to the recreational/trespasser population, interim target cleanup levels were derived for a potential occupational maintenance worker population. Although maintenance activities are not presently known to occur in the on-site landfill area, it is reasonable to assume that maintenance work could occur in this area. Potential activities might include mowing, excavation, or other activities involved in the maintenance of the on-site landfill area. Potential exposure for the maintenance worker population was assumed to consist of three exposure routes: incidental ingestion of soil, dermal contact with soil, and inhalation of vapors from soil. Inhalation of particulates was not addressed as the constituents of interest are all volatile or semivolatile organics, and volatilization of the constituents is of primary interest. If maintenance work were to occur, it was assumed that contact could potentially occur throughout the 0 to 8 feet soil interval (i.e., exposure could be to both surficial and shallow soils). Interim target cleanup level equations and exposure parameters used for the occupational maintenance worker population are presented in Table 2-8 and further discussed below.

TABLE 2-8

USEPA PART B METHOD FOR CALCULATING INTERIM TARGET CLEANUP LEVELS FOR THE OCCUPATIONAL MAINTENANCE WORKER POPULATION[a] SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT GRENADA, MISSISSIPPI

$$CS_C = \frac{TR \times BW \times AT}{EF \times ED\left[(SF_{oral} \times CF)\{(SA \times AF \times ABS) + (IR \times FI)\} + SF_{inh}\left(IR_{inh} \times ET \times \frac{1}{VF}\right)\right]}$$

(Carcinogens)

			Remarks/Source
CS_C	=	Interim target cleanup level (carcinogenic effects; mg/kg)	--
TR	=	Target risk level (10^{-6})	All carcinogens evaluated at a 10^{-6} risk level (USEPA, 1991a)
BW	=	Body weight (70 kg)	Adult body weight (USEPA, 1991a)
AT	=	Averaging time (25,550 days)	Averaging time for carcinogens is 70 years times 365 days per year (i.e., 25,550 days) (USEPA, 1991a)
EF	=	Exposure frequency (50 days/year)	One day per week (professional judgment); 50 weeks per year (USEPA, 1991b)
ED	=	Exposure duration (25 years)	Default occupational exposure duration (USEPA, 1991a)
SF_{oral}	=	Chemical-specific oral slope factor $(mg/kg\text{-}day)^{-1}$	USEPA-recommended toxicity information obtained from IRIS/HEAST (see Table 9)
CF	=	Conversion factor (10^{-6} kg/mg)	USEPA, 1991a
SA	=	Surface area (5,800 cm^2/day)	25% of adult total body area (USEPA, 1992a)
AF	=	Soil to skin adherence factor (1.0 mg/cm^2)	Recommended default upper-bound value (USEPA, 1992a)
ABS	=	Absorption factor (1% for organics)	USEPA Region IV Guidance (1992a)
IR	=	Ingestion rate (50 mg/day)	Occupational adult ingestion rate (USEPA, 1991a)
FI	=	Fraction ingested from contaminated source (1.0)	Recommended default value (USEPA, 1989a)
SF_{inh}	=	Chemical-specific inhalation slope factor $(mg/kg\text{-}day)^{-1}$	USEPA-recommended toxicity information obtained from IRIS/HEAST (see Table 9)
IR_{inh}	=	Inhalation rate (0.83 m^3/hr)	Average inhalation rate of 20 m^3/day converted to m^3/hr (USEPA, 1989a)
ET	=	Exposure time (4 hours/day)	Assumed workers would be engaged in activities for 4 hr/day (professional judgment)
VF	=	Chemical-specific volatilization factor	USEPA, 1991a; see Attachment B

TABLE 2-8 (Continued)

USEPA PART B METHOD FOR CALCULATING INTERIM TARGET CLEANUP LEVELS FOR THE OCCUPATIONAL MAINTENANCE WORKER POPULATION[a] SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT GRENADA, MISSISSIPPI

$$CS_{NC} = \frac{BW \times AT}{EF \times ED \left[\left(\frac{1}{RfD_{oral}} \times CF \right) \{ (SA \times AF \times ABS) + (IR \times FI) \} + \frac{1}{RfD_{inh}} \left(IR_{inh} \times ET \times \frac{1}{VF} \right) \right]}$$

(Noncarcinogens)

			Remarks/Source
CS_{NC}	=	Interim target cleanup level (noncarcinogenic effects; mg/kg)	--
BW	=	Body weight (70 kg)	Adult body weight (USEPA, 1991a)
AT	=	Averaging time (9,125 days)	Averaging time for noncarcinogens is 25 years times 365 days per year (i.e., 9,125 days) (USEPA, 1991a)
EF	=	Exposure frequency (50 days/year)	One day per week (professional judgment); 50 weeks per year (USEPA, 1991b)
ED	=	Exposure duration (25 years)	Default occupational exposure duration (USEPA, 1991a)
RfD_{oral}	=	Chemical-specific oral reference dose (mg/kg-day)	USEPA-recommended toxicity information obtained from IRIS/HEAST (see Table 9)
CF	=	Conversion factor (10^{-6} kg/mg)	USEPA, 1991a
SA	=	Surface area (5,800 cm^2/day)	25% of adult total body area (USEPA, 1992a)
AF	=	Soil to skin adherence factor (1.0 mg/cm^2)	Recommended default upper-bound value (USEPA, 1992a)
ABS	=	Absorption factor (1% for organics)	USEPA Region IV Guidance (1992a)
IR	=	Ingestion rate (50 mg/day)	Occupational adult ingestion rate (USEPA, 1991a)
FI	=	Fraction ingested from contaminated source (1.0)	Recommended default value (USEPA, 1989a)
RfD_{inh}	=	Chemical-specific inhalation reference dose (mg/kg-day)	USEPA-recommended toxicity information obtained from IRIS/HEAST (see Table 9)
IR_{inh}	=	Inhalation rate (0.83 m^3/hr)	Average inhalation rate of 20 m^3/day converted to m^3/hr (USEPA, 1989a)
ET	=	Exposure time (4 hours/day)	Assumed workers would be engaged in activities for 4 hr/day (professional judgment)
VF	=	Chemical-specific volatilization factor	USEPA, 1991a; see Attachment B

[a]Represents adult population only, for incidental ingestion, dermal contact, and inhalation of vapors from soils 0 to 8 feet.

For the occupational maintenance worker population professional judgment was used in determining the exposure frequency and exposure time used in the calculation of the interim target cleanup levels. The exposure frequency was based on the assumption that maintenance workers might access the site for 1 day per week for 50 weeks per year (a total exposure frequency of 50 days per year). As is recommended in the current USEPA guidance (USEPA, 1991a; USEPA, 1991b), it was assumed that two weeks per year were <u>not</u> spent in the local area. The maintenance worker exposure duration of 25 years is a USEPA standard default exposure parameter (USEPA, 1991b). Also, for the inhalation exposure route, it was assumed that the maintenance workers would only be exposed to airborne constituents for four hours per day while working at the on-site landfill area.

Variables which are not specifically discussed were based on USEPA guidance, and are so referenced in the corresponding tables, Tables 2-5 through 2-8. In determining the appropriate values to be used in the determination of interim target cleanup levels, USEPA Part A (USEPA, 1989a) and Part B (USEPA, 1991a) Guidance were consulted, as well as other sources of information including:

- "Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors," OSWER Directive 9285.6-03 (USEPA, 1991b),

- *Dermal Exposure Assessment: Principles and Applications,* Interim Report (USEPA, 1992a), and

- *Exposure Factors Handbook*, EPA/600/8-89/042 (USEPA, 1989b).

In general, variables describing the exposed populations include: contact rate (including incidental ingestion rate), exposure frequency and duration, body weight, and averaging time. Additional variables may be added depending on the exposure route. For example, additional variables for surface area (SA), adherence factor (AF), and absorption factor (ABS) are used for potential exposures via dermal contact with soil. Values may be based on default variables, site-specific information, or professional judgment. The averaging time selected depends on the type of toxic effect being assessed. When evaluating long-term exposure to noncarcinogenic toxicants, intakes are calculated by averaging intakes over the exposure duration (ED). Therefore, averaging time for noncarcinogens is a function

of exposure duration. For potential carcinogens, intakes are calculated by prorating the total cumulative dose over a lifetime of 70 years (also called a lifetime average daily intake), and the averaging time is always 70 years. The distinction relates to the currently held scientific opinion that the mechanism of action for potential toxic effects is different for noncarcinogenic and carcinogenic effects. The approach for carcinogens is based on the assumption that a high dose received over a short period of time is equivalent to a corresponding low dose spread over a lifetime (USEPA, 1989a).

2.3 TOXICITY ASSESSMENT

In order to derive interim target cleanup levels, it was necessary to conduct a toxicity assessment of the 17 organic constituents of interest. The purpose of a toxicity assessment is to weigh available evidence regarding the potential of constituents of interest to cause adverse effects in exposed individuals, and to provide, where possible, an estimate of the relationship between the extent of exposure to a constituent and the increased likelihood and/or severity of adverse effects in humans (USEPA, 1989a). Toxicity values are derived separately for potential carcinogens (slope factors or SFs) and for constituents which exhibit systemic or noncarcinogenic effects (reference doses or RfDs). RfDs and SFs are chemical specific, and are utilized in the equations presented in Tables 2-3, 2-4, 2-7, and 2-8, in conjunction with the other exposure parameters to determine interim target cleanup levels for each constituent of interest.

The USEPA has performed the toxicity assessment step for numerous chemicals and has made available the resulting toxicity information and toxicity values through its on-line toxicity database, the Integrated Risk Information System (IRIS). Second to IRIS, the USEPA recommends that the Health Effects Assessment Summary Tables (HEASTs) be consulted. The HEASTs are updated and issued on a quarterly basis and summarize interim (pending IRIS verification) toxicity factors. The current HEASTs used in the determination of the interim target cleanup levels included the Annual FY 1992 (USEPA, 1992b) and the "Supplement No. 1 to the March 1992 Annual Update" (USEPA, 1992c). Oral and inhalation toxicity factors are available in IRIS and the HEASTs.

As recommended in both the MDEQ guidance and the USEPA Part B Guidance, IRIS was used as the primary source of toxicity information. If values were not available in IRIS, the HEASTs were then consulted. If toxicity factors were not available from either source, and if no regional guidance was available (i.e., toxicity assessment guidance from USEPA Region IV), then interim target cleanup levels were not calculated for those constituents.

Carcinogens are classified in categories according to the "weight of evidence" used to support the determination that a constituent exhibits carcinogenic properties. The USEPA currently recognizes five classes of carcinogens:

Class A--Human carcinogen (sufficient evidence of carcinogenicity in humans);

Class B--Probable Human Carcinogen (B1--limited evidence of carcinogenicity in humans; B2--sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans);

Class C--Possible Human Carcinogen (limited evidence of carcinogenicity in animals or inadequate or lack of human data);

Class D--Not Classifiable as to Human Carcinogenicity (inadequate or no evidence of carcinogenicity); and

Class E--Evidence of Noncarcinogenicity for Humans (no evidence of carcinogenicity in adequate studies).

A summary of the toxicity assessment information for the 17 organic constituents of interest is presented in Table 2-9. Toxicity information was not available for three constituents: 2-hexanone, naphthalene, and 2-methylnaphthalene. Therefore, interim target cleanup levels were not determined for these constituents. In addition, toxicity information for 1,2-dichloroethene (1,2-DCE) (total) was not available. Toxicity information is available for the isomeric forms of this constituent, trans-1,2-dichloroethene and cis-1,2-dichloroethene, as well as a mixed isomer form representative of 1,1-dichloroethene. Because soil samples were measured as (total) 1,2-dichloroethene, for the purposes of calculating interim target cleanup levels, it was assumed that measured 1,2-dichloroethene was either

TABLE 2-9

TOXICITY VALUES USED IN DETERMINING INTERIM TARGET CLEANUP LEVELS
SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT
GRENADA, MISSISSIPPI

Constituent	CAS No.	Oral Slope Factor (SF) $(mg/kg\text{-}day)^{-1}$	Weight of Evidence	Source[a]	Oral Chronic RfD (mg/kg-day)	Source[a]	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Weight of Evidence	Source[a]	Inhalation Chronic RfD (mg/kg-day)	Source[a]
Acetone	67-64-1	ND[b]	D	(1)	0.1	(1)	ND	D	(1)	ND	NA[c]
2-Butanone	78-93-3	ND	D	(1)	0.05	(2)	ND	D	(1)	0.29 *	(1)
Chloroform	67-66-3	0.0061	B2	(1)	0.01	(1)	0.081 *	B2	(1)	ND	NA
Chloromethane	74-87-3	0.013	C	(2)	ND	NA	0.0063	C	(2)	ND	NA
1,2-Dichloroethene (cis)	156-59-2	ND	D	(1)	0.01	(2)	ND	D	(1)	ND	NA
1,2-Dichloroethene (trans)	156-60-5	ND	ND	NA	0.02	(1)	ND	ND	NA	ND	NA
Ethyl benzene	100-41-4	ND	D	(1)	0.1	(1)	ND	D	(1)	0.29 *	(1)
2-Hexanone	591-78-6	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA
Methylene chloride	75-09-2	0.0075	B2	(1)	0.06	(1)	0.0016 *	B2	(1)	0.86 *	(2)
2-Methylnaphthalene	91-57-6	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA
4-Methyl-2-pentanone	108-10-1	ND	ND	NA	0.05	(2)	ND	ND	NA	ND	NA
Naphthalene	91-20-3	ND	D	(1)	NA	(3)	ND	D	(1)	ND	NA
1,1,2,2-Tetrachloroethane	79-34-5	0.2	C	(1)	ND	NA	0.2 *	C	(1)	ND	NA
Tetrachloroethene	127-18-4	ND	ND	NA	0.01	(1)	ND	ND	NA	ND	NA
Toluene	108-88-3	ND	D	(1)	0.2	(1)	ND	D	(1)	0.11 *	(1)
1,1,2-Trichloroethane	79-00-5	0.057	C	(1)	0.004	(1)	0.056 *	C	(1)	ND	NA
Trichloroethene	79-01-6	0.011	ND	(4)	ND	NA	0.006	ND	(4)	ND	NA
Xylene (total)	1330-20-7	ND	D	(1)	2.0	(1)	ND	D	(1)	ND	NA

[a]Sources: (1) IRIS 3/30/93; (2) HEAST (March 1992); (3) HEAST Supplement (November 1992); (4) USEPA Region IV, 1992b.
[b]ND indicates no data was available.
[c]NA indicates that data was not available in either IRIS (3/30/93), HEAST (March 1992), or HEAST Supplement (November 1992).

* indicates that the toxicity value has been derived from a unit risk.

100 percent cis-1,2-DCE or 100 percent trans-1,2-DCE. Therefore, two interim target cleanup levels may be used to represent 1,2-dichloroethene (total).

Trichloroethene (TCE) was the primary constituent of interest in the soils associated with the on-site landfill. The carcinogenicity assessment for TCE has been withdrawn from the IRIS database (including the slope factors), the oral and inhalation reference dose information is pending, and toxicity information is not available in HEAST. However, USEPA Region IV guidance addresses the issue of the lack of toxicity data for TCE. USEPA Region IV guidance indicates that the TCE carcinogenic toxicity information was withdrawn from IRIS due to controversy over the weight of evidence classification (whether TCE is a B2 or C carcinogen). In fact, the Guidance presents IRIS Carcinogen Risk Assessment Verification Endeavor (CRAVE) Workgroup reviewed oral and inhalation slope factors for use in risk assessment evaluations of TCE (see Appendix C). These values have been used in the determination of interim target cleanup levels for TCE and are presented in Table 2-9. For the MDEQ method of determining interim target cleanup levels, a B2 weight of evidence (the more conservative) classification was assumed.

It should be noted that where a constituent exhibited both noncarcinogenic and carcinogenic levels, and had both an RfD and SF, both types of effects were considered in the calculation of interim target cleanup levels.

2.4 DERIVATION OF INTERIM TARGET CLEANUP LEVELS

Interim target cleanup levels were determined using the equations, exposure parameters, and toxicity information presented in the preceding sections. Use of the MDEQ method resulted in a maximum of two interim target cleanup levels for the same constituent: (1) levels for constituents with potential carcinogenic properties (MDEQ-C) and (2) levels for constituents with noncarcinogenic properties (MDEQ-NC). Use of the USEPA Part B method resulted in a maximum of four interim target cleanup levels for the same constituent: (1) levels for constituents with potential carcinogenic properties evaluated using the recreational/trespasser population exposure scenario (USEPA, R/T-C); (2) levels for constituents with noncarcinogenic properties evaluated using the recreational/trespasser population exposure scenario (USEPA, R/T-NC); (3) levels for constituents with potential carcinogenic properties evaluated using the occupational maintenance worker

population exposure scenario (USEPA, M-C); and (4) levels for constituents with noncarcinogenic properties evaluated using the occupational maintenance worker population exposure scenario (USEPA, M-NC).

Using the MDEQ method, interim target cleanup levels for those constituents exhibiting potential carcinogenic properties were determined using a target risk level of 10^{-6} for Class A and B carcinogens, and a target risk level of 10^{-5} for Class C carcinogens (MDEQ, 1990). For the USEPA method, a 10^{-6} target risk level was assumed for all three classes, i.e., Class A, Class B, and Class C. Noncarcinogens were evaluated by setting a target hazard index (i.e., noncarcinogenic risk) level of 1.0, as recommended for both the MDEQ method and the USEPA method. Appendix D contains the spreadsheets used to calculate the interim target cleanup levels; Appendix B is supporting documentation for the modeling of the volatilization factor (VF) for the constituents measured in the on-site soil samples. These modeled volatilization factors were utilized in the determination of interim target cleanup levels using the USEPA method for the occupational maintenance worker population for the inhalation of vapor exposure route.

Table 2-10 presents a summary of the range of interim target cleanup levels determined using the MDEQ and USEPA methodologies. Also presented in this table is the range of concentrations of the constituents detected in the on-site soil samples of interest, the number of on-site soil samples in which the maximum measured concentration exceeded the minimum interim target cleanup levels, and the standard low level detection limits for each constituent of interest.

TCE was the only constituent for which there were measured concentrations in on-site soils which exceeded the calculated interim target cleanup levels. The minimum value for the interim target cleanup level for TCE, 7.8 mg/kg, was determined using the USEPA methodology for the occupational maintenance worker population. This exposure scenario was based on the assumption that exposure could occur through incidental ingestion, dermal contact, and the inhalation of vapors from both surficial soils and soils up to 8 ft in depth (a 0 to 8 ft depth interval). As noted in Table 2-10, there were 12 measured concentrations of TCE which exceeded the minimum interim target cleanup level. The locations at which these concentrations were measured are shown in Figure 2-1 and include: SB-2 (2 to 4 ft and 6 to 8 ft); SB-3 (0 to 0.5 ft, 2 to 4 ft, and 6 to 8 ft); SB-4 (0 to 0.5 ft, 2 to 4 ft, and 6 to 8 ft); SB-13 (6 to

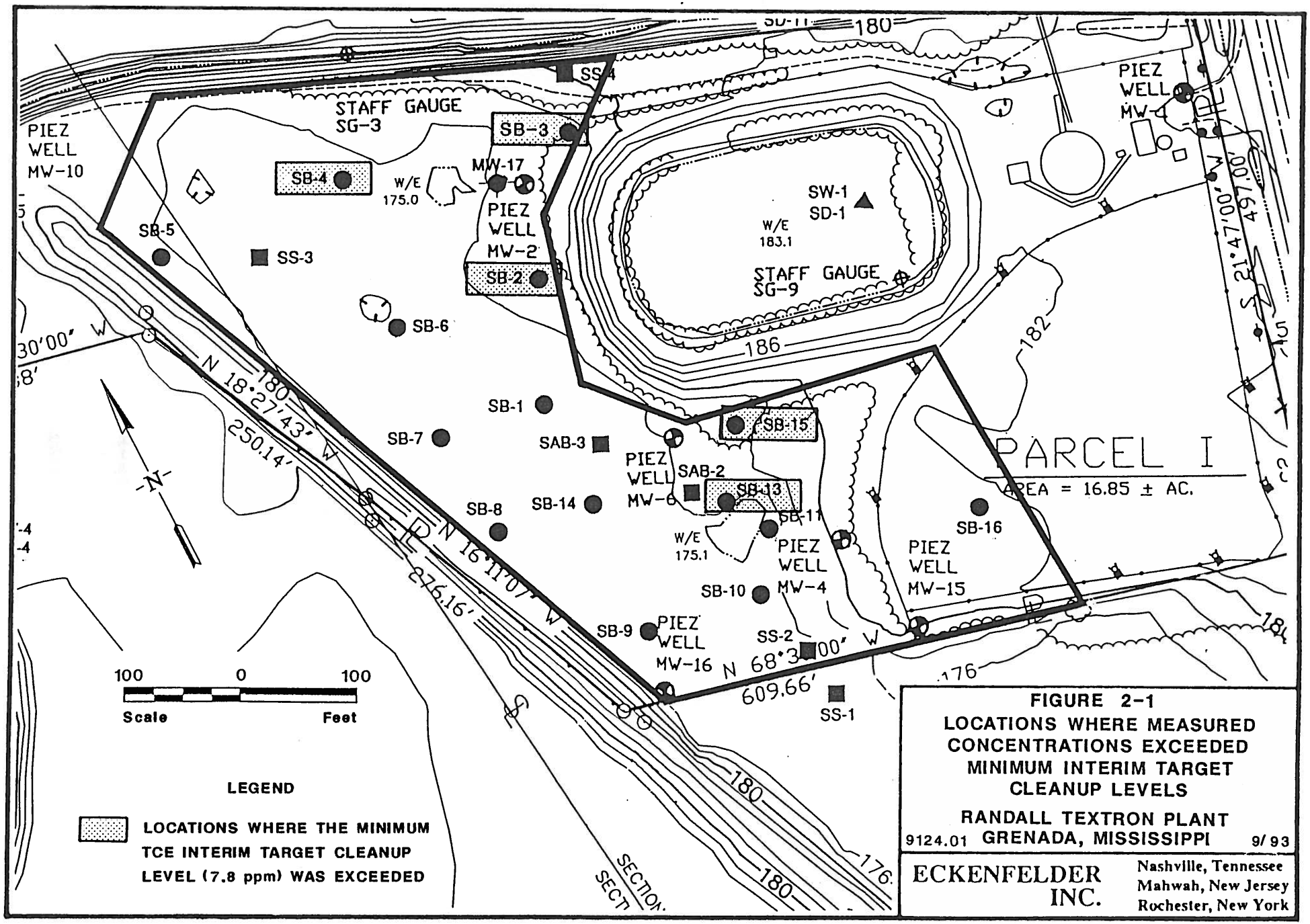


FIGURE 2-1
LOCATIONS WHERE MEASURED CONCENTRATIONS EXCEEDED MINIMUM INTERIM TARGET CLEANUP LEVELS

RANDALL TEXTRON PLANT
9124.01 **GRENADA, MISSISSIPPI** 9/93

ECKENFELDER INC.
Nashville, Tennessee
Mahwah, New Jersey
Rochester, New York

TABLE 2-10

SUMMARY OF INTERIM TARGET CLEANUP LEVELS
SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT
GRENADA, MISSISSIPPI

Constituent	Range of Interim Target Cleanup Levels[a] (mg/kg)	Range of Detection[b] (mg/kg)	Number of Samples Exceeding Minimum Interim Target Cleanup Level	Standard Low Level Detection Limit[c] (mg/kg)
Acetone	8,000 (MDEQ-NC) - 470,000 (USEPA, M-NC)	0.035-20	0	0.005
2-Butanone	4,000 (MDEQ-NC) - 140,000 (USEPA, R/T-NC)	0.032-0.37	0	0.01
Chloroform	0.85 (USEPA, M-C) - 47,000 (USEPA, M-NC)	0.0033-0.0099	0	0.001
Chloromethane	3.5 (USEPA, M-C) - 540 (MDEQ-C)	0.095	0	0.002
cis-1,2-Dichloroethene	800 (MDEQ-NC) - 47,000 (USEPA, M-NC)	0.0034-64	0	0.001[d]
trans-1,2-Dichloroethene	1,600 (MDEQ-NC) - 95,000 (USEPA, M-NC)	0.0034-64	0	0.001[d]
Ethyl benzene	7,900 (USEPA, M-NC) - 280,000 (USEPA, R/T-NC)	0.0063-17	0	0.001
2-Hexanone	NA[e]	0.019	NA	0.002
Methylene chloride	20 (USEPA, M-C) - 170,000 (USEPA, R/T-NC)	0.33	0	0.002
2-Methylnaphthalene	NA	3.6-6.5	NA	0.067
4-Methyl-2-pentanone	4,000 (MDEQ-NC) - 240,000 (USEPA, M-NC)	0.0052-0.025	0	0.002
Naphthalene	NA	2-3.6	NA	0.067
1,1,2,2-Tetrachloroethane	1.1 (USEPA, M-C) - 35 (MDEQ-C)	0.0034-0.87	0	0.001
Tetrachloroethene	800 (MDEQ-NC) - 47,000 (USEPA, M-NC)	0.002-5.9	0	0.001
Toluene	1,700 (USEPA, M-NC)- 560,000 (USEPA, R/T-NC)	0.0031-84	0	0.001

TABLE 2-10 (Continued)

SUMMARY OF INTERIM TARGET CLEANUP LEVELS
SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT
GRENADA, MISSISSIPPI

Constituent	Range of Interim Target Cleanup Levels[a] (mg/kg)	Range of Detection[b] (mg/kg)	Number of Samples Exceeding Minimum Interim Target Cleanup Level	Standard Low Level Detection Limit[c] (mg/kg)
1,1,2-Trichloroethane	2.5 (USEPA, M-C) - 19,000 (USEPA, M-NC)	0.03-2.3	0	0.001
Trichloroethene	7.8 (USEPA, M-C) - 600 (USEPA, R/T-C)	0.0042-5,400	12[f]	0.001
Xylene (total)	160,000 (MDEQ-NC) - 9,500,000 (USEPA, M-NC)	0.0032-93	0	0.001

[a]Range presented encompasses all scenarios for both MDEQ and USEPA methodologies. "C" indicates the interim target cleanup level was based on the carcinogenic equations; "NC" indicates noncarcinogenic equations; "R/T" indicates the recreational/trespasser population; and "M" indicates the maintenance worker population.

[b]Measured concentrations of volatile organics have been converted from μg/kg to mg/kg; see Table 2-2.

[c]Standard low level detection limit converted from parts per billion (ppb) to parts per million (ppm) for Method 8240 (purge and trap) for volatile organics and for Method 8270 (sonication extraction) for semivolatile organics.

[d]Detection limit is for 1,2-dichloroethene (total).

[e]"NA" indicates that toxicity factors were not available for these constituents; therefore, interim target cleanup levels could not be determined.

[f]Sample locations where measured TCE concentrations exceeded the minimum in the range (7.8 mg/kg) included the following: SB-2 (2-4 ft and 6-8 ft); SB-3 (0-0.5 ft, 2-4 ft, and 6-8 ft); SB-4 (0-0.5 ft, 2-4 ft, and 6-8 ft); SB-13 (6-8 ft); and SB-15 (0-0.5 ft, 2-4 ft, and 6-8 ft). Measured concentrations in samples SB-15 (2 to 4 ft) and SB-3 (6 to 8 ft) also exceeded the maximum in the range (600 mg/kg). See Figure 2-2 and Appendix A.

8 ft); and SB-15 (0 to 0.5 ft, 2 to 4 ft, and 6 to 8 ft). A review of the analytical data for the on-site soil samples of interest reveals that there were two detections of TCE which exceeded the maximum interim target cleanup level of 600 mg/kg: 1,500 mg/kg at SB-15 (2 to 4 ft) and 5,400 mg/kg at SB-3 (6 to 8 ft).

Comparison of the minimum interim target cleanup levels to the standard low level detection limits indicates that all of the interim target cleanup levels are above corresponding detection limits.

3.0 TREATABILITY STUDY

As presented in Section 2.0, "Derivation of Interim Cleanup Levels", TCE is the primary constituent of interest in soils associated with the on-site landfill. In addition, TCE was the only constituent that exceeded the calculated interim cleanup levels in one or more soil samples. The minimum interim cleanup level for TCE was calculated to be 7.8 mg/kg as determined using the USEPA methodology for the occupational maintenance worker population assuming exposure through incidental ingestion, dermal contact, and inhalation of vapors from surficial soils and soils up to 8 feet in depth. Twelve soil samples exceed the minimum interim cleanup level. Two of these samples also exceeded the maximum interim cleanup level of 600 mg/kg.

An initial assessment of remedial technologies for the TCE-containing soils identified ex situ vapor stripping as a potentially cost-effective treatment option. Therefore, this treatability study was focused on the effectiveness of treatment for the ex situ vapor treatment for the removal of TCE. The treatability study approach, results, and conclusions are presented below.

3.1 SITE CHARACTERISTICS

Based on the interpretation of boring logs, the soils at the site consist of silts and clays with traces of very fine sand to a depth of eight to ten feet. The soils are either undifferentiated alluvial deposits from the flood plain of the Yalobusha River or the weathered Basic City Shale member of the Tallahatta Formation. The soils appear to form a confining layer for the saturated sandy soils below. The upper soils range from moist near the surface to effectively saturated within two feet of the surface due to perched water. The transition from moist to saturated soils occurs at different depths across the site with some areas containing standing water during portions of the year. The near surface soils contain enough fine particles to form clumps when moist and exhibit considerable plasticity when wet.

The major chemical of concern in the area being considered for interim treatment is trichloroethylene which has been found at levels as high as 5,400 mg/kg in the soils between the surface and the aquifer. Other contaminants of interest found in at least one sample at levels above 10 mg/kg but not exceeding 100 mg/kg are acetone,

plating waste

1,2-dichloroethene, ethylbenzene, toluene, and xylene. Contami[illegible] one sample in concentrations exceeding 1 mg/kg but not exceeding 10 mg/kg are 2-methylnaphthalene, naphthalene, tetrachloroethene, and 1,1,2-trichloroethane. Constituents not exceeding 1 mg/kg are 2-butanone, chloroform, chloromethane, 2-hexanone, methylene chloride, and 4-methyl-2-pentanone. Chromium is also present in the soils in concentrations ranging to 11,700 mg/kg with the highest levels being in the upper six inches of soil.

3.2 REMEDIAL TECHNOLOGY DESCRIPTION

The treatment concept evaluated by this study could be implemented in a number of ways. One way, would involve tilling or plowing of soils in place. A second option would involve excavation of contaminated soils combined with evaporative removal of the volatile constituents of interest in a soil cell. This approach is a combination of soil vapor extraction and soil cell bioremediation techniques. This technology would involve the excavation of soils, mixing with sand and gravel to increase soil porosity, and placement in a lined cell. Air would be pulled through the soils using a vacuum system connected to several slotted pipes located within the soils. The recovered air would be treated before discharge to the atmosphere or recycled.

For both treatment concepts blending of soils with sufficient sand and/or gravel would likely to be used to improve both the permeability and handling characteristics of the soils. This may involve the partial drying of soils within a vapor control area before mixing with sand and gravel to improve handling characteristics. If the soils cell concept is employed the blended soils would be placed on a lined cell foundation prepared by grading an appropriate treatment area, spreading a few inches of coarse gravel over an impermeable liner, and covering the gravel with a geomembrane fabric. The soils would be placed in approximately two foot lifts with slotted PVC pipe being located in staggered lines at two and four foot intervals. The soil pile would be covered with a secured impervious liner. The PVC pipe would be manifolded to a vacuum extraction system. The recovered air would be treated using activated carbon canisters in series.

A blower would be utilized to extract air from the cell and would be operated until the volatile concentrations in the off-gas reach an asymptote or are below the detection limit. Soil samples would be collected and composited for analysis.

When soil samples indicate site specific clean-up criteria have been achieved they would be removed from the treatment area and returned to the excavation area. Additional batches of soils would then be treated in the same manner until all of the designated soils have been addressed.

3.3 TREATABILITY STUDY APPROACH

3.3.1 Test Objectives and Rationale

The objectives of the test were to determine the ease of volatilization of TCE and the apparent requirements for blending to improve soil handling characteristics. It was deemed more cost effective to identify potential problems and evaluate the soil handling characteristics on a small scale rather than during a field pilot study.

3.3.2 Experimental Design and Features

The experimental design included on-site sampling and testing of relatively clean soils for blending requirements, and sampling of contaminated soils for blending and testing in the laboratory. Clean samples were to be obtained from near the apparent zero line down to a depth where perched water was present. The soils were to be blended with various proportions of sand, gravel, and/or gypsum. Once an appropriate blend was identified, soils would be obtained from an area reported to have near the highest levels of contamination.

The contaminated soils were to be placed in a sealable container and brought back to the ECKENFELDER INC. laboratory. The soils would be blended based on the information obtained with the tests conducted with clean soils. The blended soils were to be placed in glass columns. Air was to be passed through the soils at a rate that would exchange soil volumes at a frequency similar to that which might be occur in a full scale field application. Similar columns were to be constructed and tested using unamended contaminated soils.

Aliquots of the soil would be sampled initially and at selected intervals to establish the rate of reduction in concentrations of the volatile constituents, especially TCE. The final proportions and effects of blending materials would be utilized to determine whether and how to proceed to a field scale test.

Prior to implementing the field study an improvement in the test design was made. Instead of bringing the contaminated soils back to the laboratory for blending and column construction, the blending was to be done on site with the blended soils being placed in two foot long, 4-inch diameter PVC pipe. The pipe would be capped and taped. This eliminated concerns with regards to loss of volatiles during transport and handling in the laboratory. A complete description of the field and laboratory tests in presented in Appendix E.

3.3.3 Equipment and Materials

Field equipment and materials consisted of a shovel, pitch fork, hand gardening tools, plastic bins, sampling jars, PVC pipe and caps, an OVA meter, and health and safety equipment. Laboratory equipment included an air supply, valves, meters, tubing, and a top loader balance.

3.3.4 Sampling and Analysis

The area of known contamination had been sampled on previous occasions for both volatiles and metals. These data indicated that the soil TCE levels ranged from approximately 10 mg/kg in the upper six inches, to 250 mg/kg in the 2 foot to four foot interval, and to between 100 mg/kg and 2,500 mg/kg in the six to eight foot interval.

During the test, the soils taken in three portions from the 2 to 10 inch, 10 to 20 inch, and 20 to 25 inch intervals were blended and sampled. The soils were also sampled after blending with sand and gravel. After two, four, and six weeks, the four aerated columns and a sample of the blend which was placed in an open dish in a fume hood were periodically stirred at the same frequency. Samples of blended soils that were kept in a sealed PVC pipe were also collected at four and six weeks and submitted for analysis. Sampling was done by transferring soils from the PVC pipes to a plastic tray located in a fume hood. Several aliquots were used to fill a 120 mL VOA jar. Following sampling the soils were immediately transferred back to the PVC pipe and attached to the aeration manifold.

Soils were analyzed for volatiles by solvent extraction/gas chromotography using EPA Method 8240. Some samples were also analyzed by purge and trap, EPA Method 8240.

3.3.5 Data Management

All data sheets, field notes, and laboratory notes were reviewed by the Task Manager and maintained in the project files.

3.3.6 Deviations from Work Plan

The major deviation from the initial work plan was the blending and transferring of soils to the columns in the field rather than the laboratory. A second change was the inclusion of a test conducted in an open dish.

3.4 RESULTS AND DISCUSSION

3.4.1 Analysis Of Treatability Data

The treatability test data is summarized in Tables 3-1, 3-2, and 3-3. The analytical reports are presented in Appendix F. As reported in the Tables, soils that were obtained from the upper two feet of the highest contamination area and blended on site had an initial concentration of approximately 21 mg/kg. Further mixing of the soils to mimic the amount of physical activity and exposure to the atmosphere during blending with sand and gravel resulted in a reduction in TCE levels to approximately 8.9 mg/kg.

After 16 days of treatment the TCE levels were 2.0 mg/kg for the unamended soils and 1.2 mg/kg (1.6 mg/kg when adjusted for dilution) in the blended samples. After 33 days of treatment the TCE levels were 1.5 mg/kg for the unamended soils and 0.25 mg/kg - 0.3 mg/kg (Table 3-1) when adjusted for dilution (Table 3-2) in the blended samples. This amounts to a greater than 98 percent reduction from the time when the soil samples from different depths had been mixed which does not take into account losses that occurred during excavation and mixing.

The only other volatile component detected was methylene chloride which ranged from below 0.25 mg/kg to 0.9 mg/kg (Table 3-3). All samples that were not below the detection limit were listed as J. There was no clear pattern to the data and the range of values was very small. It is not clear that methylene chloride is present in the soils.

TABLE 3-1

TCE LEVELS IN ROCKWELL/GRENADA SOIL MIXTURE AND BLENDS[a]
SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT
GRENADA, MISSISSIPPI

Date	Days of Treatment	Soil Batch 1				Soil Batch 2	
		Mix[b]	Blend[c]	Treated Pipe[d]	Dish[e]	Mix[b]	Treated Pipe[d]
3/17/93	0	21	7.4	NA[b]	NA	10(7.8)[7]	NA
4/2/93	16	NM[8]	6.2	1.9(0.5)	0.7	NM	1.7(3.3)
4/19/93	33	NM	2.6	0.26(0.23)	0.85	NM	2.2(0.8)

[a]Milligrams/kilogram (ppm)
[b]Soils blend from two depths in equal amounts; 6"-12" and 12" - 18".
[c]Soils blend with sand and gravel (10:2:1)
[d]Soils treated by passing air through PVC pipe.
[e]Soils treated in open dish located in fume hood.
[f]Not applicable.
[g]Numbers in parenthesis are duplicate tests.
[h]Not measured.

TABLE 3-2

ADJUSTED TCE LEVELS IN ROCKWELL/GRENADA SOIL MIXTURE AND BLENDS[a]
(ADJUSTED FOR DILUTION)
SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT
GRENADA, MISSISSIPPI

Date	Days of Treatment	Soil Batch 1				Soil Batch 2	
		Mix[b]	Blend[c]	Treated Pipe[d]	Dish[e]	Mix[b]	Treated Pipe[d]
3/17/03	0	21	9.6	NA	NA	1.0(7.8)	NA
4/2/93	16	NM	8.1	1.6	0.9	NM	2.0
4/19/93	33	NM	3.4	0.3	1.1	NM	1.5

[a]Milligrams/kilogram (ppm)
[b]Soils blend from two depths in equal amounts; 6"-12" and 12" - 18".
[c]Soils blend with sand and gravel (10:2:1)
[d]Soils treated by passing air through PVC pipe.
[e]Soils treated in open dish located in fume hood.
[f]Not applicable.
[g]Numbers in parenthesis are duplicate tests.
[h]Not measured.

TABLE 3-3

ADJUSTED METHYLENE CHLORIDE LEVELS IN ROCKWELL/GRENADA SOIL MIXTURE AND BLENDS[a]
SOIL INTERIM REMEDIAL ACTION

RANDALL TEXTRON PLANT
GRENADA, MISSISSIPPI

Date	Days of Treatment	Soil Batch 1				Soil Batch 2	
		Mix[b]	Blend[c]	Treated Pipe[d]	Dish[e]	Mix[b]	Treated Pipe[d]
3/17	0	<0.25	0.45B	NA	NA	0.4(0.4)JB	NA
4/2	16	NM	0.95	<.25(0.9)J	0.1J	NM	<.25(0.9)J

[a]Milligrams/kilogram (ppm)
[b]Soils blend from two depths in equal amounts; 6"-12" and 12" - 18".
[c]Soils blend with sand and gravel (10:2:1)
[d]Soils treated by passing air through PVC pipe.
[e]Soils treated in open dish located in fume hood.
[f]Not applicable.
[g]Numbers in parenthesis are duplicate tests.
[h]Not measured.

3.4.2 Comparison To Test Objective

The first test objective was to determine the effects of blending the soils with material to increase porosity and handling characteristics including sand, gravel, and gypsum. This was accomplished and identified a 10:2:1 blend of soil to sand to gravel. The effect of moisture (which caused clumping) on the ease of blending was also observed. The second objective was to determine if the TCE levels could be reduced to or below the site specific interim cleanup criteria and if this could be accomplished in a reasonable time frame. The tests demonstrated that TCE levels could be reduced to below the levels of concern and that this reduction could be accomplished rapidly for the specific soils tested under the conditions of the test.

3.4.3 Quality Assurance Quality Control

The test analytical data was reviewed for internal consistency by comparison of both duplicate tests and some duplicate samples. Duplicate analysis of TCE in the soil mixture without blending had reported values of 10 μg/kg and 7.8 μg/kg indicating good mixing and good reproducibility of the analytical procedure. Duplicate test for soils without sand/gravel after 16 days of treatment were 1.7 μg/kg and 3.3 μg/kg of TCE, while the samples blended with sand/gravel had duplicate test TCE concentrations of 1.9 μg/kg and 3.3 μg/kg, again showing good consistency, particularly considering the low concentrations of TCE present at that time.

3.5 CONCLUSIONS

Based on the perched water conditions observed at the time of sampling, it appears the upper two feet of soils can be readily mixed with sand and gravel and treated by aeration. Deeper soils were observed to contain a higher moisture content and will likely require some drying before blending in order to improve the handling characteristics. Mixing of the native soils with sand and gravel resulted in some improvement in reduction of volatile constituents, but more importantly, improved handling characteristics and increased porosity. This may allow the soil treatment cells to be constructed to greater depth. The amount of material addition is estimated at roughly 30 percent; 20% sand and 10% gravel. The use of both sand and gravel yielded better results than either one alone. The addition

of gypsum in addition to sand and gravel appeared to have minimal benefit. Tests showed that the addition of the sand first, rather than the gravel, was, at least, marginally better in terms of handling characteristics. Simultaneous addition of sand and gravel was not evaluated.

Treatment of the soils by blending and air flow resulted in significant decreases in TCE levels. Blending of mixed soils with sand and gravel, alone, resulted in a decrease in TCE levels from 21 mg/kg to 9.6 mg/kg, a 54 percent decrease. Subsequent treatment by aeration (6 pore volumes per day) resulted in further reduction to 1.6 mg/kg (adjusted for dilution) after 16 days and to 0.26 mg/kg after 33 days for reductions of 92 percent and 98.8 percent respectively. Overall TCE reduction from the in-ground concentrations in this study was found to be greater than 99 percent.

The process evaluated by this study, as determined from the tests, shows sufficient promise of applicability such that a field demonstration/interim action is feasible and warranted.

4.0 ENGINEERING EVALUATION FOR SOIL INTERIM REMEDIAL ACTION

This section presents the results of the engineering evaluation for the soil interim remedial action concept. The interim cleanup level previously presented in Section 2.0 and the treatability test results presented in Section 3.0 were used to develop and estimate costs for an engineering concept.

As previously discussed, interim remediation of shallow soils in the vicinity of the on-site landfill is being considered as a method to reduce migration potential through removal of contaminant mass and to reduce potential risk associated with contamination at the site. The Remedial Investigation has identified trichloroethylene (TCE) and chromium as being the major constituents of interest in these soils. Section 2.0 had establish an interim cleanup level for TCE of 7.8 mg/kg. This level was derived using USEPA methodology. Section 3.0 discussed the results from a limited treatability study, aeration of soils blended with sand and gravel. The treatability study results showed greater than 99 percent reduction in TCE levels, to approximately 0.15 mg/kg for the specific soils tested. Toxicity Characteristic Leaching Procedure (TCLP) tests using the aerated soils resulted in chromium levels which were below method detection limits.

4.1 CLEANUP LEVELS/REGULATORY CONSIDERATIONS

As discussed previously, the proposed interim cleanup level for TCE is 7.8 mg/kg, which was derived using risk-based methodology. This cleanup level was then compared to regulatory criteria, specifically the Land Disposal Restrictions (LDRs), to determine the requirements for disposal and to identify treatment levels that are technology-based standards rather than risk-based standards. Since the soils also contain chromium, the review of the LDRs in "EPA Regulations on Land Disposal Restrictions", 40 CFR 268, was directed at two constituents: chromium and TCE. Both chromium and TCE are restricted waste constituents for land disposal and the soils should meet the applicable treatment standards for specific waste codes prior to land disposal. The waste code applicable for chromium is D007 and potential waste codes applicable for TCE are D040, F001, and U228. Subpart D of 40 CFR 268 was reviewed using the potential waste codes for the constituents. Section 268.41 has treatment standards expressed as concentrations in waste extract using the Toxicity

Characteristic Leaching Procedure (TCLP) method for extraction. This section specifies a treatment standard of 5.0 mg/L for total chromium (D007) "non wastewaters" and no treatment standard identified for the TCE potential waste codes. Treatment standards expressed as waste concentrations (total concentration) are identified in Section 268.43. Chromium (D007) has a treatment standard of 5.0 mg/L identified for "wastewater". TCE has a treatment standard of 5.6 mg/L for "non wastewaters" and 0.054 mg/L for "wastewaters" if it is a F001 or U228 listed waste. No treatment standard is identified for TCE listed as D040. Following is a summary of the applicable "non wastewater" landban treatment standards:

- Chromium: 5.0 mg/L (determined by TCLP);
- Trichloroethene: 5.6 mg/L (determined by total concentration).

The analytical results from the site indicate that the initial soil TCE levels are above the landban treatment standards and would require treatment if the material is to be disposed off-site. Additionally, a TCLP analysis was conducted on two samples from the upper two feet of soils that were treated through aeration. The result of the TCLP analysis for chromium was below the method detection limit. Therefore, it appears that treatment prior to land disposal is required for TCE and may not be required for chromium. Furthermore, the land disposal restrictions require that TCE be treated to at least 5.6 mg/L prior to land disposal. This level is also potentially relevant and appropriate for re-depositing the soil at the site once the soil has been excavated.

4.2 VOLUME OF SOIL TO BE ADDRESSED

Approximately 8,100 cubic yards (cu yd) of soil were preliminarily identified for treatment in this interim remedial action. The volume was determined by using isocon maps which depict the TCE concentrations in the soil at the zero to one-half foot depth, two to four foot depth, and six to eight foot depth sample intervals. (See Figures 4-1, 4-2, and 4-3, respectively.) As discussed earlier, treatment for chromium does not appear necessary, therefore the estimate only reflects a volume determined for treatment of TCE in soils above the derived Interim Cleanup level of 7.8 mg/kg. The top one foot of soil was not included in the volume estimate since it contains TCE levels which are just slightly above the cleanup level of 7.8 mg/kg and it is anticipated that this soil will meet the cleanup level after the soil is scraped

it is anticipated that this soil will meet the cleanup level after the soil is scraped from the site and moved into a stockpile. The volume of soil to be excavated from one foot to four foot depth was estimated to be 5,300 cubic yards, of which 690 cubic yards may not require treatment. The soil which may not require treatment is from an area identified on the isoconcentration map as being below the cleanup level, however, this soil would have to be excavated to access deeper soils which are above the cleanup level. Due to the location of the excavation and variability of TCE concentrations, it may not be possible to isolate soil that is below the cleanup level from soil that is above the cleanup levels. Therefore, as a conservative measure, the 690 cubic yards was included in the volume. The volume in the one to four foot depth was estimated by multiplying the area where TCE levels were shown to be 7.8 mg/kg or greater on the isoconcentration map (2 to 4 feet sample interval) by a depth of 3 feet. Soils immediately adjacent to the lagoon that exceed the 7.8 mg/kg cleanup level, however, were excluded because it may not be possible to excavate the soil due to stability problems that might result. Either a stability analysis would be necessary prior to excavation, to determine how close to the toe of the lagoon's slope it is safe to excavate or excavation in this area would have to be conducted cautiously as will be required around the existing monitoring wells. For the purpose of this estimate, it was assumed that the excavation would stop at the lagoon fence (approximately 20 feet from the toe of the lagoon's slope). The volume of soil in the four to six foot depth range was estimated in a similar way by using an area represented by a TCE concentration of 7.8 mg/kg or greater on the (6 to 8 ft sample interval) isoconcentration map and multiplying by a depth of two feet. The volume estimated in the four to six foot depth range was 2,800 cubic yards. Soils above the 7.8 mg/kg cleanup level and deeper than six feet were not included in the estimate due to the concern that excessive groundwater would flow into the excavation and because soils at these depths are not expected to be intruded under reasonable risk scenarios. The preliminary area of excavation proposed for this interim remedial action is depicted on Figure 4-4 and the estimated volumes at various depths are summarized below.

- 0 to 1 ft depth: 1,800 cubic yard;
- 1 to 4 ft depth: 5,300 cubic yard;
- 4 to 6 ft depth: 2,800 cubic yard.

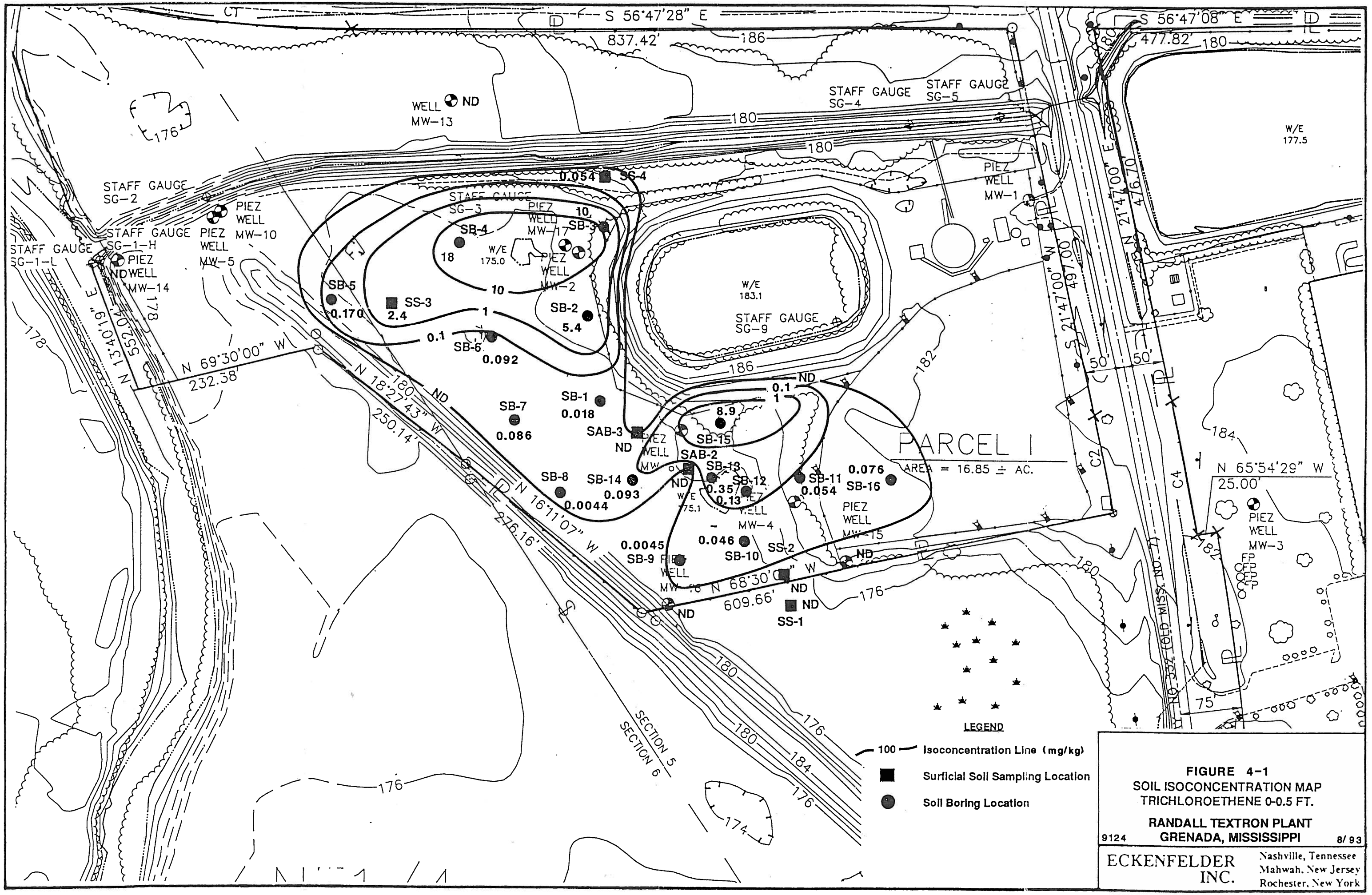


FIGURE 4-1
SOIL ISOCONCENTRATION MAP
TRICHLOROETHENE 0-0.5 FT.

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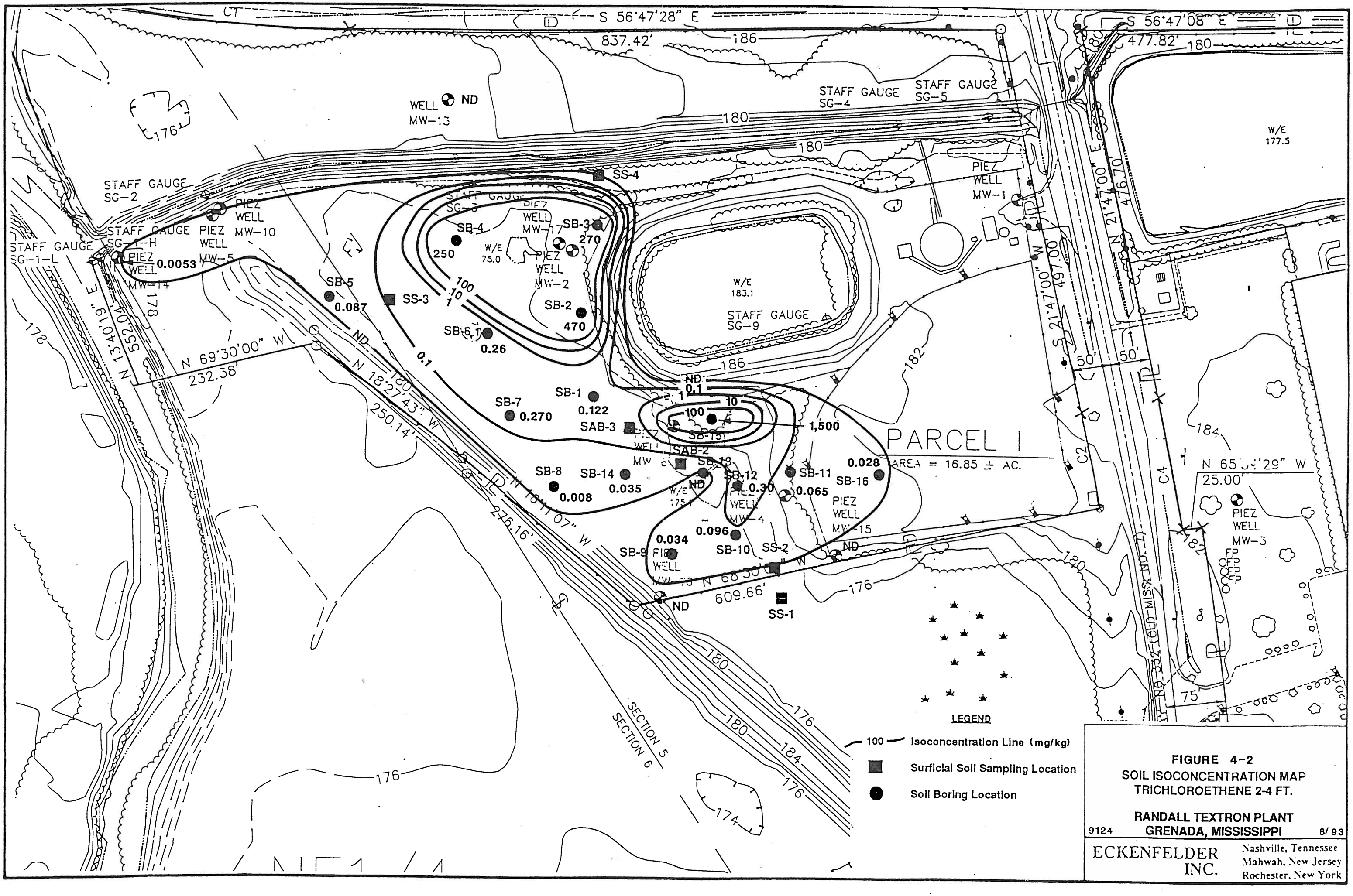

FIGURE 4-2
SOIL ISOCONCENTRATION MAP
TRICHLOROETHENE 2-4 FT.

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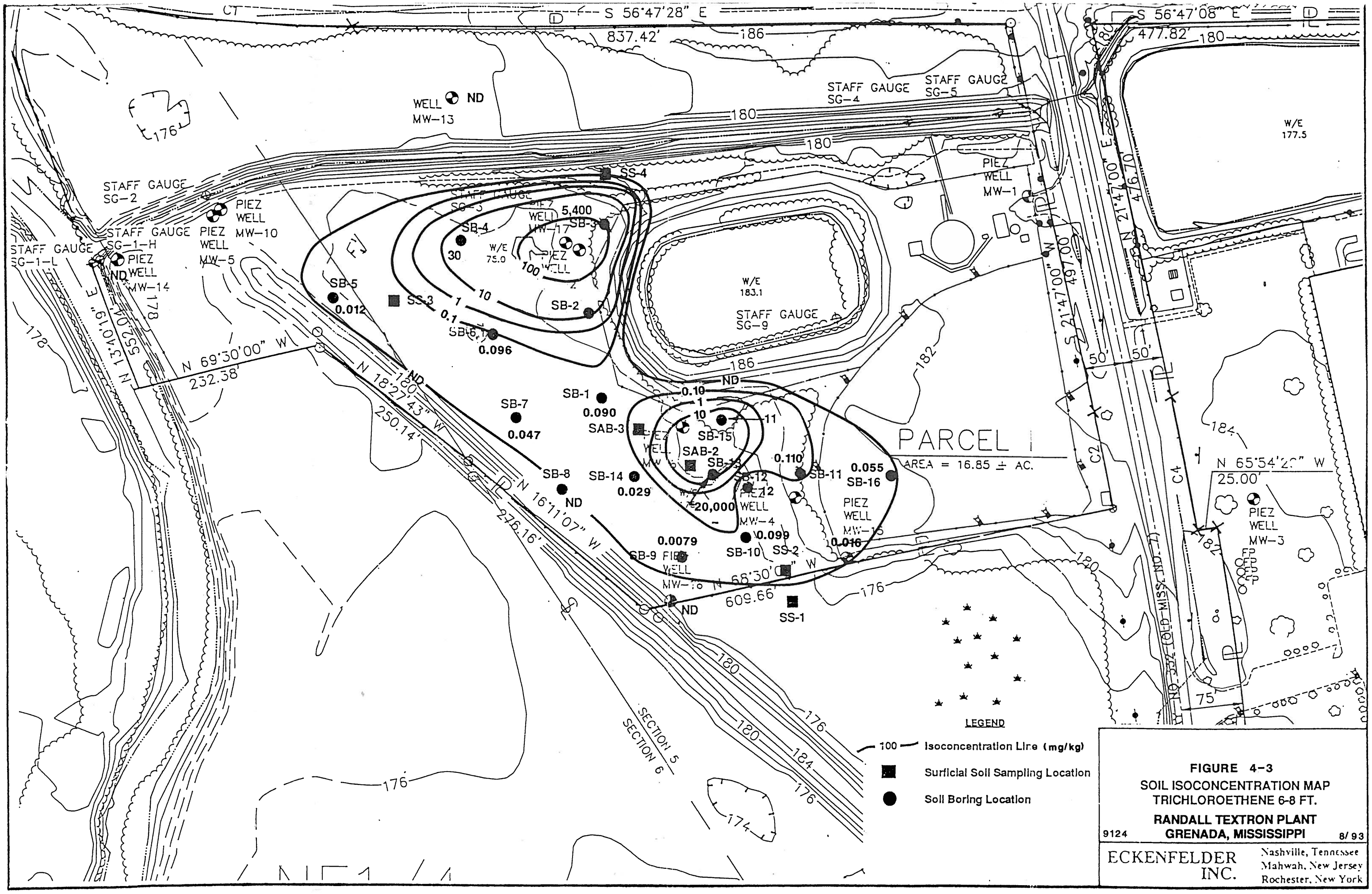

FIGURE 4-3
SOIL ISOCONCENTRATION MAP
TRICHLOROETHENE 6-8 FT.
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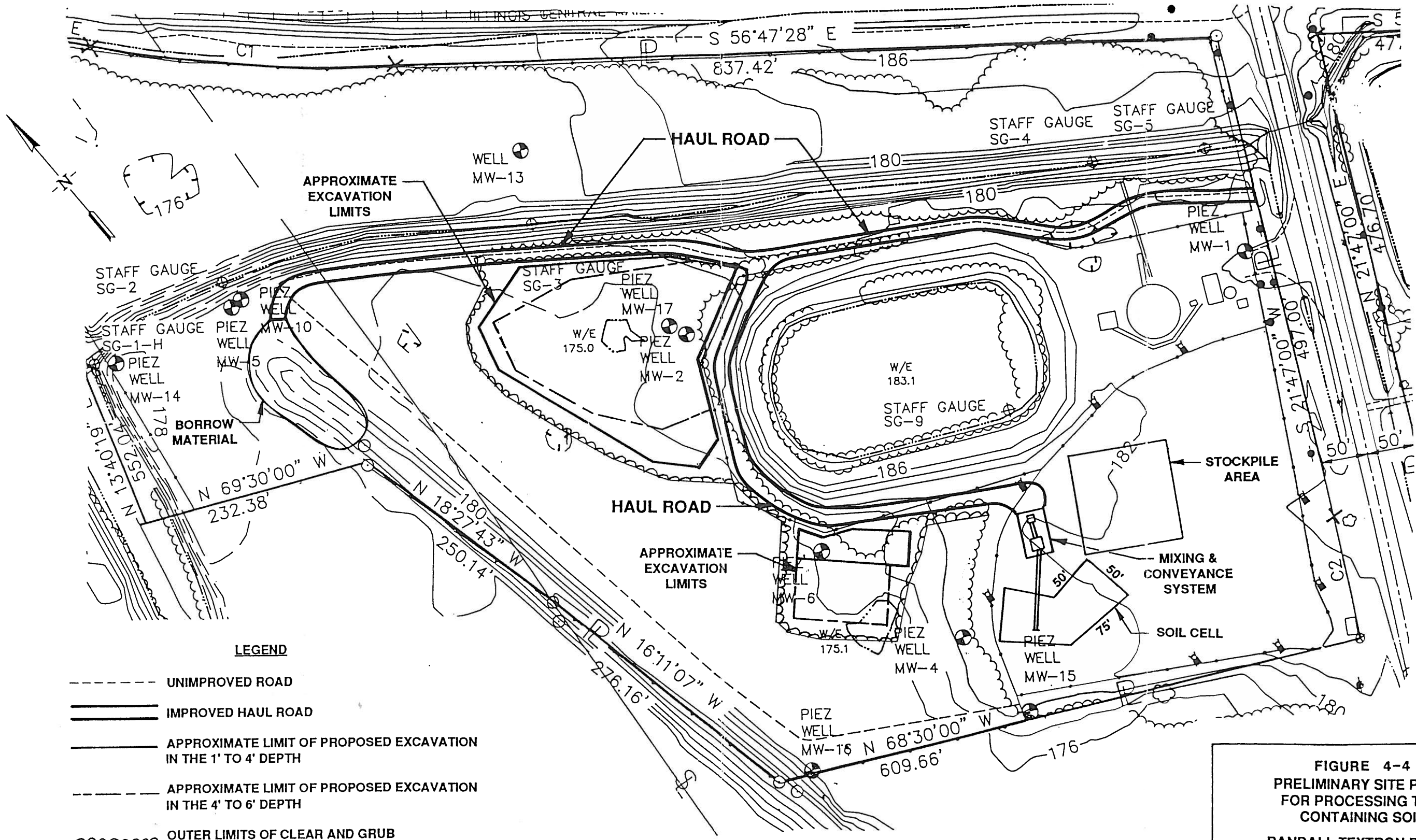

LEGEND

- UNIMPROVED ROAD
- IMPROVED HAUL ROAD
- APPROXIMATE LIMIT OF PROPOSED EXCAVATION IN THE 1' TO 4' DEPTH
- APPROXIMATE LIMIT OF PROPOSED EXCAVATION IN THE 4' TO 6' DEPTH
- OUTER LIMITS OF CLEAR AND GRUB

NOTE: The exact locations of the processing equipment, haul roads, and excavation areas are preliminary and are subject to modification.

APPROXIMATE SCALE: 1" = 100'

FIGURE 4-4
PRELIMINARY SITE PLAN FOR PROCESSING TCE CONTAINING SOIL

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4.3 ENGINEERING CONCEPT

The interim action as envisioned herein will consist of several unit processes:

- clearing site of vegetation, and chipping vegetation followed by disposal on-site,
- gravel placement to provide haul roads for earth moving and transporting equipment, a containment/work area for a pug mill, and electrical and security facilities
- excavation and stockpiling of soils to a depth of approximately one foot, chemical analyses, and, if TCE levels are satisfactory, reuse as top soil,
- excavation and transportation of a small portion of the targeted soils to a mixing area for blending with sand and gravel, stockpiling, and analysis,
- excavation dewatering and temporary storage of water in trailer mounted tank for off-site disposal or treatment on-site,
- construction of a soil treatment cell base, unless shown to be unnecessary,
- loading blended soils in a stockpile or directly on the cell,
- recovery of off-gases from soils and treatment of the soil gas with activated carbon,
- returning treated soils to excavation area,
- analysis of stockpiled soils. Based on results of analysis, soil will be transported to the excavation, treated in the cell, or reprocessed through the pug mill,
- based on initial batch results, additional batches of soil will be processed, and site restoration performed.

The primary process is ex-situ vapor stripping of excavated soils that have been blended with sand and gravel. The process will take place in an enclosed soil cell that controls air emissions. It appears that the levels of TCE in the upper foot of soils are sufficiently low that excavation and handling to form a stockpile will reduce the TCE levels to below the derived interim cleanup levels. Further, some portion of the soils will quite likely be sufficiently treated as a result of excavation and blending the soils with sand and gravel in a pug mill.

The conceptual design envisions testing of the soil treatment process on a moderate scale prior to committing to treatment of all targeted soils. If treatment of the first batch of soils is satisfactory, the remaining soils will then be treated. The plan also calls for evaluation and process modification for several unit processes as described below.

Initially the site would be prepared by removal of trees, stripping and stockpiling the upper foot of soils, and sampling to confirm whether the interim cleanup level has been met for the surficial soils. Next, approximately 200 cubic yards of soils representative of the range of levels of TCE and moisture will be excavated, analyzed, blended with sand and gravel in a pug mill, sampled, reanalyzed, and stockpiled. Rapid turn around analysis or on site analysis will determine the relationship between initial and post-pug mill treatment moisture and TCE levels. This information will be used to determine if soil cell treatment is needed, and to provide an estimate of the volume of soils requiring soil cell treatment in addition to pug mill mixing, thus allowing more efficient logistical planning.

If the results of the pug mill mixing tests show that a substantial portion of the soils will need further treatment in a soil cell, a soil cell will be constructed and additional soils will be excavated and mixed with sand and gravel in the pug mill. The excavated soils will be blended and either stockpiled or deposited directly on the soil cell depending on their initial moisture content and TCE level according to on-site testing such as head space analysis. Stockpiled soils will be sampled and analyzed to determine if the interim cleanup levels have been met. If these levels have not been met the soils will be either passed through the pug mill for a second time or designated for soil cell treatment. This approach should reduce both cost and time of remediation by reducing soils handling and the time required for additional batches to be treated in the soil cell. Sufficient soils might be excavated at this

stage such that only one or two more excavation events will be required. The decision will be based on the feasibility and cost of stockpiling a few thousand yards of soil versus the savings realized by fewer mobilization/demobilization and dewatering events. The volume of soil that might be satisfactorily treated using the pug mill will also be a factor.

During the first loading of the soil cell, soils will be segregated within the cell based on TCE and moisture content to provide information regarding the effect of these two variables on the treatment time. Subsequent loadings might be managed so that soil treatment times for soils throughout the cell will be relatively uniform in order to reduce the total treatment time.

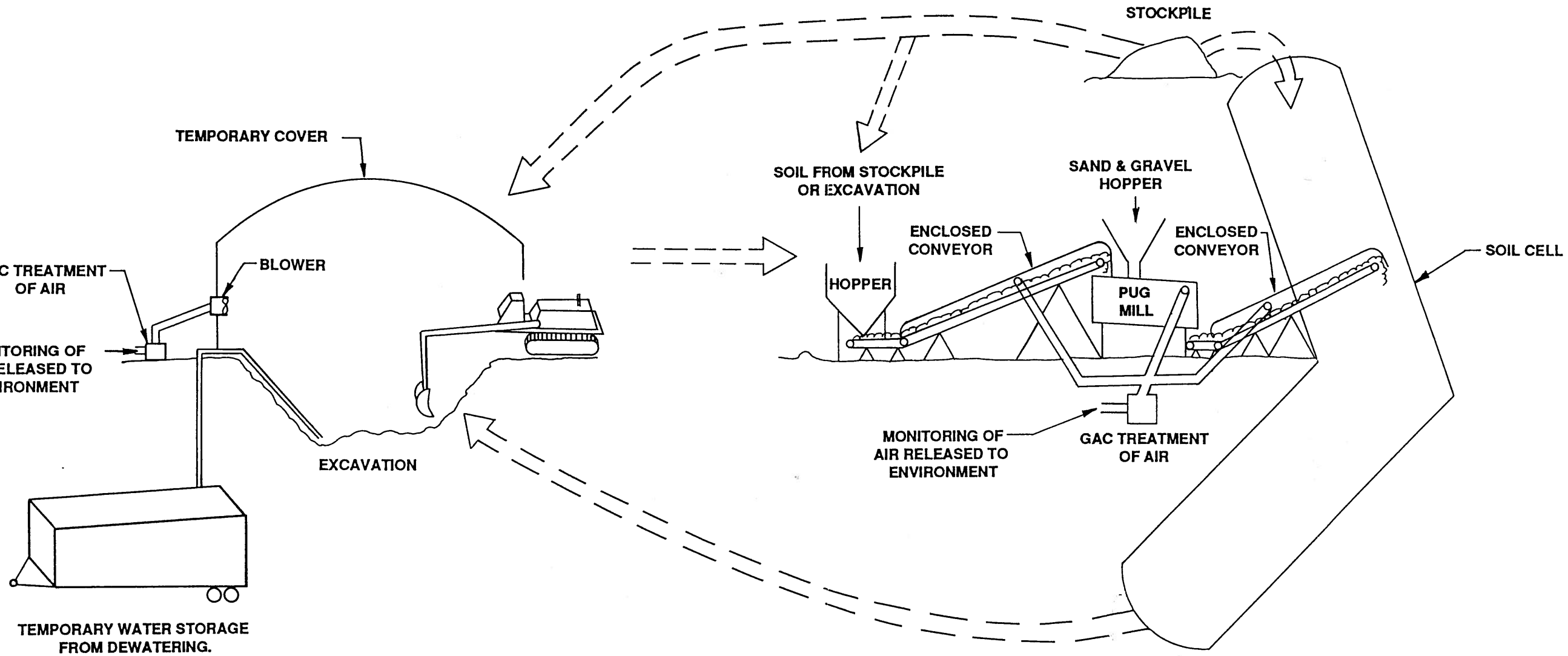
This plan has been developed with decision points incorporated to allow for opportunities to modify and further develop the logistics of the project to improve efficiencies and to determine whether to proceed with treatment of the remaining soils. It also allows for input from the construction contractor with regard to minimizing soil handling costs.

4.4 UNIT PROCESSES

A conceptual flow diagram of the overall unit processes is presented in Figure 4-5. These unit processes are discussed in detail below.

Site Preparation: The extent of excavation will be staked. Trees will be cut, chipped, and disposed of on-site.

Treatment Zone Preparation: Haul roads and the equipment staging area will require improvements to support movement of transportation equipment, the placement of stationary equipment, and removal of a section of the ballpark fence. Improvements to the haul road will consist of placing gravel over the existing road and building a new haul road in some areas of the site. The pug mill loading and access area will be underlain by a high density polyethylene (HDPE) liner to reduce the potential for contamination of the underlying soils. The linear will be covered by fill material and gravel to protect the liner and support the equipment. The potential locations of the haul roads, mixing area, stockpile area and soil cell are shown in Figure 4-4. These are preliminary and may change based on siting



NOTE:
1. Stockpile, soil cell, and mixing & conveyance equipment shall have an impervious containment system underneath and a method to minimize untreated releases into the air.
2. The exact processing equipment and site controls are preliminary and are subject to modification.

NOT TO SCALE

FIGURE 4-5
CONCEPTUAL SCHEMATIC FOR PROCESSING TCE CONTAINING SOIL
RANDALL TEXTRON PLANT
GRENADA, MISSISSIPPI

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constraints and process logistics. Fill material needed to form road beds or to grade work areas will be obtained from a borrow area located along the unused dummy line that runs along the west side of the on-site landfill. Electricity, lighting, fencing, etc. will be provided as necessary. A power line will be run from a power pole along the highway. A pug mill, conveyor belts, and sand and gravel piles will be located for efficient handling and processing of soils and to allow soils blended in the pug mill to be transferred to either a stockpile or the soil cell using enclosed conveyors.

Surficial Soils: Soils will be removed from the upper one foot and stockpiled. The stockpile will be underlaid and covered with plastic. Samples of stockpiled soils will be collected and analyzed to determine if, following excavation and handling, the soil TCE levels are below the interim cleanup standards. If treatment is required, the soils will be passed through the pug mill and further tested. We do not expect that soil cell treatment of these soils will be required based on the derived interim soil cleanup levels.

Preliminary Blending Test: Approximately 200 cubic yards of soils representative of the range of moisture and TCE levels found in the targeted soils will be excavated, mixed with sand and gravel (20 percent and 10 percent by volume, respectively) in the pug mill, and stockpiled prior to construction of a soil cell. Comparison of TCE concentrations before and after mixing will determine which soils need further processing; either by soil cell or pug mill treatment. The information attained at this stage will be sufficient to estimate the volume of soils requiring further processing and thus the number of batches of soils to be treated with a soil cell. The results of the preliminary test will also provide enough information to determine whether it is cost effective to modify the size of the soil cell.

Fugitive Emission Control: In order to manage the loss of volatiles during handling and processing an enclosed pug mill and enclosed conveyor will be used with an air collection system. The recovered gas will be treated using granular activated carbon (GAC). A movable cover will be used to collect air emissions during excavation of the more highly contaminated soils. Workers will wear respirators. The work area and site perimeter will be monitored using HNU or OVA meters. If predetermined levels of volatiles are exceeded, work in that specific area will be

interrupted and the exposed soils covered with plastic until working procedures can be modified.

Water Management: Some dewatering is anticipated to be necessary during excavation. Recovered water will be stored and hauled off-site in a trailer mounted tank or will be treated on-site using a portable water treatment system. It may also be advantageous to allow some of the soils to gravity drain prior to processing the soils with the pug mill. The extent to which this is necessary or beneficial will be determined during the preliminary testing period. The volume of recovered water will determine whether it is cost effective to treat water on-site. Since groundwater in the top six feet of soil is perched water, it is impossible to obtain an accurate estimate of the volume of water which may need to be recovered. The volume will depend on the time of year and on the amount of rain received prior to and during excavation. As a conservative estimate, the volume of the excavation was multiplied by a porosity factor of 0.40 to give a water volume of 700,000 gallons. At this volume, on-site treatment may be less expensive than off-site treatment.

Soil Cell Construction: The soil cell will be located such that the soils exiting the pug mill can be delivered to the soil cell using a combination of two conveyors. This will reduce soil handling costs, minimize compaction, and maximize permeability in the constructed cell. The cell base will be constructed by grading, if necessary, placing an impermeable liner, adding four to six inches of gravel, and covering the gravel with a geotextile fabric cover. A blower and manifold will be installed on the side of the cell opposite the pug mill. The off-gas treatment system will either be located to allow treatment of off-gases from both the cell and the pug mill/conveyor vapor control system or a separate system will be used. A representative schematic of a soil cell treatment system is presented in Figure 4-6.

Soil Treatment: Based on the results of the preliminary blending test, soils will be excavated, blended, and either stockpiled, placed on the soil cell for treatment, or passed through the pug mill for a second time to further reduce TCE residuals. The stockpiled soils will be underlaid and covered by an impermeable liner. Soils placed on the cell and stockpile will be covered to control moisture and minimize emissions. As the soils are placed on the cell, perforated PVC pipes will be installed at 10 feet horizontal intervals and at a height of three feet above the geotextile fabric. The pipes will be connected to a blower through a manifold system. The blower

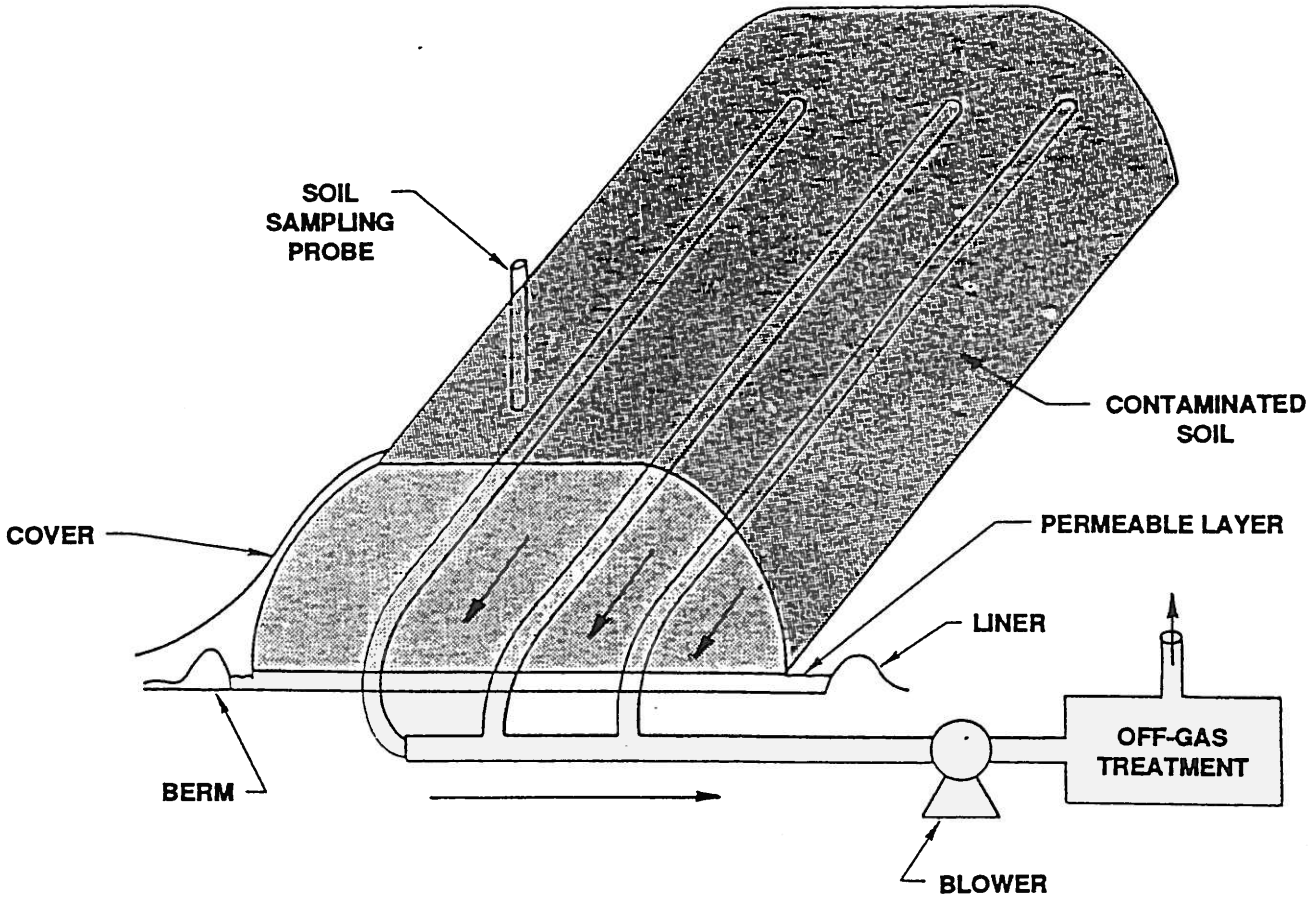

FIGURE 4-6
SCHEMATIC OF
SOIL CELL TREATMENT SYSTEM

RANDALL TEXTRON PLANT
9124 GRENADA, MISSISSIPPI 8/93

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discharge will be connected to a gas treatment system (activated carbon). The maximum depth of the soil cell will be six feet. Air will be recovered from every other pipe with the remaining pipes being used as air inlets. Periodically, the flow direction will be reversed or all pipes will be used for extraction. TCE levels in the recovered air will be measured to determine when soil samples should be collected and analyzed for treatment confirmation.

It is anticipated that approximately one-third to one-half of the soils will be excavated and processed through the pug mill at this stage. The soils will be placed directly onto the soil cell or stockpiled. Stockpiled soils will be sampled and analyzed to determine which soils can be placed back in the excavation and which will need further treatment using either the soil cell or the pug mill. Once soils placed on the cell have been treated to below the interim cleanup level, they will be removed and returned to the excavation. Some of the soils from the stockpile will be placed on the soil cell. Other soils will be run through the pug mill again. Soils treated by either method will be returned to the excavated area.

One or two more excavation/treatment events will occur. The amount of soil to be excavated and either stockpiled or added directly to the soil cell during each soil excavation event will be determined based largely on the economics of mobilizing/demobilizing the pug mill, dewatering costs, the percent of soils that can be sufficiently treated through excavation, handling, and blending in the pug mill compared to the practicality of excavating all of the soils to be addressed in a single event. It is likely that several refinements will be implemented based on the results and observations of the first event.

Restoration: Once all of the soils have been treated and returned to the excavation area the site restoration will be implemented. Expansion of the soils and dilution from sand and gravel will result in an increase in the volume of material and thus an increased in the average elevation in the area. The final contours will need to be determined. It will also be necessary to determine if and what vegetation will be introduced. The ball park area will be returned to pretreatment conditions and sampled to demonstrate that surficial contamination did not result inadvertently from the interim remediation activities.

4.5 PERMITTING REQUIREMENTS

Until recently, the site was being managed as a State Superfund site and under the supervision of the MDEQ's Superfund Division. Typically, Superfund sites are exempt from obtaining permits for interim or emergency remedial actions. More recently, it appears that this portion of the site may be placed under RCRA regulation. The RCRA Subtitle C Program also allows for interim corrective actions or emergency permits. Regardless of the regulatory framework under which this action falls the pertinent permitting requirements would be evaluated. The intention of all permitting requirements would still have to be followed and a letter of intent describing the remedial action, types of constituents, emissions or discharges, and location of the site should be filed with the appropriate permitting offices for approval. A letter of approval and exemption from obtaining a permit should also be obtained from the various permitting offices prior to implementation of the remedial action. The exact permitting requirements for this interim action will be determined during the design phase.

4.6 COST

The overall cost for excavating, treating by ex-situ vapor stripping, and re-depositing approximately 8,100 cubic yards of soil from the site compares favorably with more conventional methods of treatment. Other on-site treatment technologies appear to be at least double the cost of ex-situ vapor stripping. The cost for off-site treatment and disposal could be as much as ten times the cost of the proposed method. Further treatment evaluations anticipated to be conducted during implementation may demonstrate further cost-effectiveness of ex-situ vapor stripping.

4.7 ADDITIONAL CONSIDERATIONS

Further detailed planning will be conducted once a remedial action contractor is selected. The process will be evolutionary with several decisions being made as a result of observations made at critical junctures. Some decisions will be whether to proceed further while others will select logistical approaches that appear to maximize cost efficiency.

The cost of the interim remedial action is based on a TCE cleanup level of 7.8 mg/kg or similar level.

Not all soils at the site containing TCE at concentrations above 7.8 mg/kg are to be treated. Soil adjacent to the lagoon and soils greater than 6 feet deep are not included.

Critical decision points include whether or not to run a 200 cubic yard trial run through the pug mill prior to constructing the soil cell. If the soil cell is not needed this will save approximately $47,260. However, this would require down time or mobilization/demobilization costs for the pug mill which might exceed this amount and could slow the project down by several days.

The size of the soil pile needs to be further evaluated based on the amount of soil to be treated and tradeoffs in some of the other costs. It would also be beneficial to know what fraction of the soils will be sufficiently treated by the soil cell. The ratio of sand and gravel to soils will also affect the volume of soils to be placed in the cell. Currently a ratio of 10:2:1 of soil: sand: gravel is contemplated based on the laboratory tests. This ratio may be adjusted as a result of observations made as soils are processed through the pug mill. Small (hand) scale mixing tests could also be used for further evaluation of the blending ratio.

The initial tests should probably be conducted with soils from the smaller area closer to the ball field in order to minimize handling costs. It might then be feasible to postpone tree removal, grubbing, and removal of top soil from the larger area until the pug mill and soil cell treatment processes have been tested.

It should be recognized that there is the potential for recontamination of the soils after they are returned to the excavated area.

5.0 PROTECTION OF GROUNDWATER

The interim remedial action for soil will be protective of groundwater by removing a substantial mass of TCE from the soil, thereby reducing the source of impacts to groundwater. The interim remedial action alone, which is of limited extent, is not anticipated to remove sufficient source material to reduce groundwater concentrations to levels below MCLs; however, within the context of an overall site remediation, the interim action will contribute significantly to the groundwater cleanup objectives. Appropriate concentration levels for soil cleanup will ultimately be determined for the overall site remediation based upon an evaluation of site conditions, but because these concentration levels are not yet available, they can not be applied to the interim cleanup. However, a preliminary evaluation of leaching of TCE from the soil zone to be treated during the interim remediation has been conducted to verify that the proposed interim soil cleanup level (7.8 mg/kg) is consistent with the ultimate objective of groundwater protection.

A numerical model simulation of TCE leaching from soil to groundwater was used to predict the mass of TCE expected to leach from the soil over time. This model was coupled with an estimate of dilution of the TCE leachate by groundwater to determine the resultant concentrations of TCE anticipated in groundwater over time. This model ignored TCE inputs from sources other than the treated soil, and ignored existing concentrations of TCE in groundwater, and therefore represents an idealized simulation of mass transfer of TCE to groundwater from the treated soil zone only.

The leaching simulation was conducted using the computer code VLEACH (Version 1.02) as developed by CH2M Hill (1990) for the U.S. Environmental Protection Agency, Region IX. This code calculates mass transport of TCE from the soil to groundwater based upon partitioning of TCE between the aqueous, gaseous, and solid components of the soil. The simulation accounts for loss of TCE to the atmosphere by volatilization based upon Fick's Second Law, and for advection of TCE to the groundwater based upon an average, steady-state annual recharge rate. Calculations of TCE partitioning between soil particles and water are based upon an soil organic carbon partitioning coefficient coupled with an soil organic carbon concentration. Calculations of TCE partitioning between water and soil air were

based upon the Henry's constant for TCE. Limiting assumptions of the model include the following:

- The partitioning coefficients are constants.
- The liquid, vapor, and sorbed phases are in equilibrium in each cell of the model.
- Liquid-phase dispersion can be neglected.
- No non-aqueous phase liquid TCE is present in the soil.
- Degradation of TCE can be ignored.
- The simulated soil zone is a homogenous porous medium.
- Volatilization from the soil surface is completely unimpeded.

Pertinent input values for the model are as follows:

- Organic carbon distribution coefficient (Koc) for TCE was 65 ml/g as reported by the Hazardous Substances Databank, May 1992.
- The dimensionless form of Henry's constant (Kh) for TCE was 0.62 as converted from the value reported by Montgomery and Welkom (1990).
- Free air diffusion coefficient for TCE was 0.62 m^2/day as estimated by Lyman, et al. (1990).
- Area of the treated soil deposit was estimated to be 36,450 square feet based on the soil area currently containing greater than 7.8 mg/kg TCE.
- Depth of the treated soil deposit was estimated to be 6 feet.

- Dry bulk density of the soil was estimated to be 1.4 gm/cm^3 based upon classification as a clay loam (after addition of sand and gravel during treatment) and the relationship plotted in Table 5.10 in USEPA (1993).

- Total effective porosity was estimated to be 0.41 from Table 5-42 in USEPA (1993).

- Volumetric water content was estimated to be 0.32 from Table 5-25 in USEPA (1993).

- Soil organic carbon content was estimated to be 0.0153 based upon the average of two measured values collected from depths of 0 to 2 feet and 4 to 6 feet. The average value was corrected to account for dilution of the organic carbon caused by mixing sand and gravel with the soil. An average of the two measured values was considered appropriate because the soil will be mixed during treatment.

- The initial concentration of TCE in the treated soil was assumed to be 7.8 mg/kg.

Details of the theoretical basis and mechanics of the VLEACH code are discussed in the previously referenced document.

The calculation of leachate dilution upon mixing with groundwater in the saturated aquifer is patterned after the procedure presented for Summer's model (USEPA, 1989). Leachate that recharges the aquifer during a defined period (one year) is assumed to mix completely with groundwater that flows beneath the area of treated soil during the same period. The resulting concentration in groundwater is calculated as follows:

$$Cgw = \frac{CpQp}{Qp + Qa}$$

where:

Cgw = the resulting concentration of TCE in the groundwater

Cp = the concentration of TCE in the leachate

Qp = the volumetric rate of recharge through the treated soil deposit

Qa = the volumetric rate of groundwater flow in the aquifer beneath the treated soil deposit

The rate of groundwater flow through the aquifer is based upon the hydraulic conductivity of the aquifer as determined from single well aquifer tests (slug tests), the hydraulic gradient as derived from potentiometric surface maps of the aquifer, and application of Darcy's law:

$Qa = AiK$

Slug test results indicate that the hydraulic conductivity (K) of the aquifer averages approximately 13.8 feet/day (geometric mean). The hydraulic gradient (i) across the area of the proposed interim action was approximately 0.0055 feet/feet on July 7, 1993. The thickness of the aquifer, based upon drilling information, is approximately 17 feet, and the width (perpendicular to groundwater flow) of the area to be treated is estimated to be 200 feet based upon distribution maps of TCE in soil. The product of the width and depth is the area (A) through which groundwater in the aquifer flows. Using these values in Darcy's law results in a groundwater flow rate (Qa) of 258 cubic feet/day (94,192 cubic feet/year).

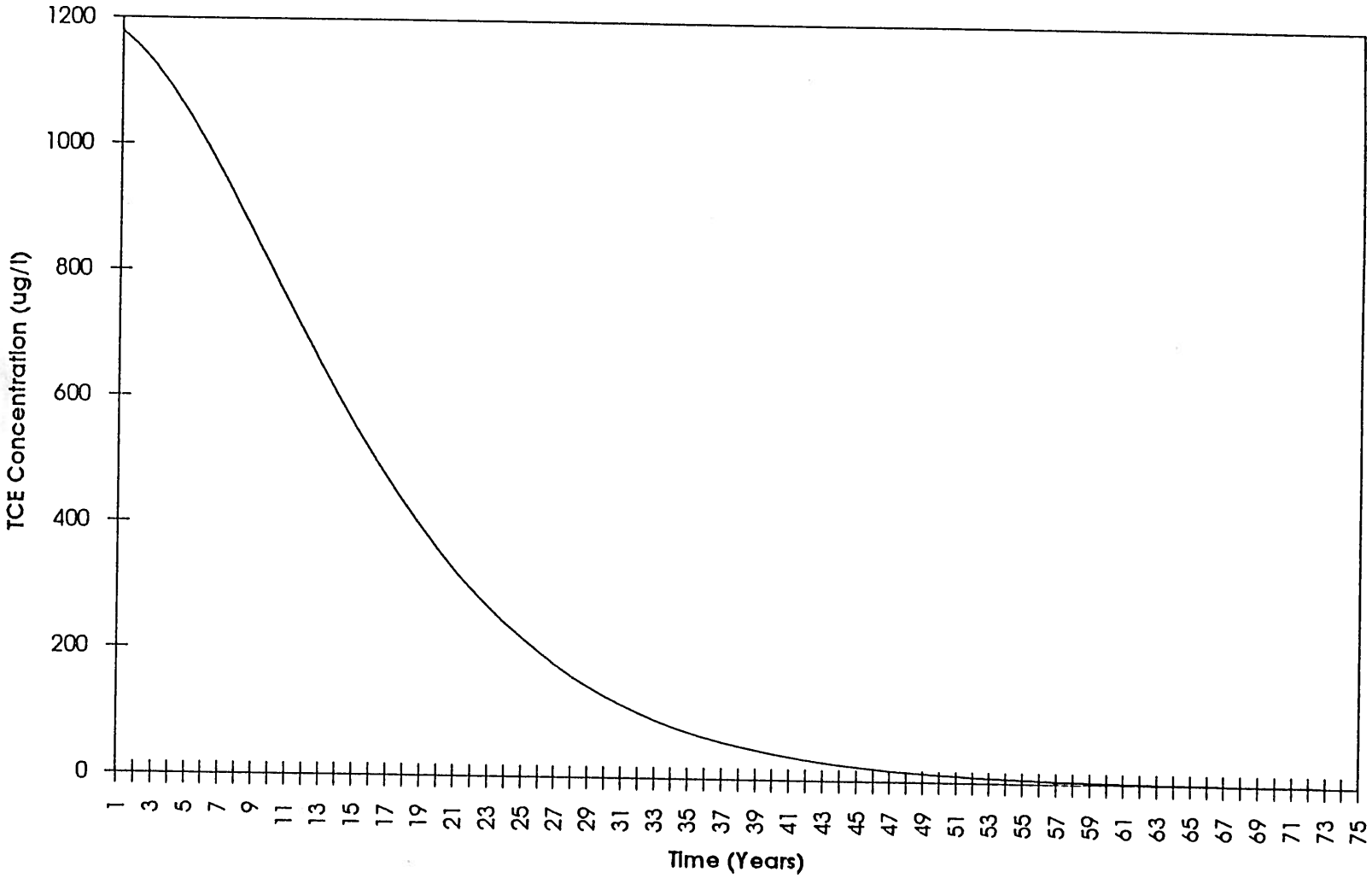
The average annual rate at which leachate recharges the aquifer is estimated to be equal to the average annual rainfall of 53 inches/year (U.S. Department Commerce, 1992) as recorded in Greenwood, Mississippi from 1951 to 1980, less 80 percent of the average annual pan evaporation of 57 inches/year. (U.S. Department of Commerce, 1966). Eighty percent is a correction factor for converting measured pan evaporation rates to evapotranspiration rates for turf grass assuming moderate wind and average relative humidity greater than 70 percent (USEPA, 1988,

Table 3-12). The resulting estimated recharge rate is 7.4 inches/year (0.62 feet/year). The estimated area of 36,450 square feet for the treated soil multiplied by the recharge rate gives 22,599 cubic feet/year of recharge (Qp) expected annually from the treated soil area.

The model was used to simulate leaching during a 75 year period, with calculations of the resulting TCE concentrations in groundwater performed once per year. The results are plotted in Figure 1. The plot demonstrates that groundwater concentrations of TCE resulting from leaching of the treated soil are predicted to decrease and approach non-detectable concentrations during the simulation period in response to a decreasing mass of TCE in the soil. The TCE concentration in groundwater is predicted to achieve the MCL of 5.0 μg/L in approximately 55 to 60 years.

Remedial actions for groundwater are anticipated at this site, and the time required to remediate groundwater is expected to be long because the aquifer at the site contains non-aqueous phase liquid TCE. Protection of groundwater based upon the predicted attenuation of TCE leaching from soils that have been treated during the proposed interim action is consistent with the probable timeframe expected for groundwater cleanup.

Figure 1 -- Predicted TCE Concentration In Groundwater



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APPENDIX A

ANALYTICAL RESULTS FOR ON-SITE SOIL SAMPLES OF INTEREST FROM 0 TO 8 FT--VOLATILE ORGANICS (PPB) AND SEMIVOLATILE ORGANICS (PPM)

N/S Coor.	E/W Coor.	Sample Type	Depth	Date of Collection	Lab Sample No.	Sample ID	Chloromethane (µg/kg)	Bromomethane (µg/kg)	Vinyl Chloride (µg/kg)	Chloroethane (µg/kg)
--	--	GD	0-0.5 Feet	8/8/91	5146	SAB-2	250 U+	250 U+	250 U+	250 U+
--	--	G	0-0.5 Feet	8/8/91	5147	SAB-2	250 U+	250 U+	250 U+	250 U+
--	--	G	0-0.5 Feet	8/8/91	5148	SAB-3	95 JD	5.0 U+D	5.0 U+D	5.0 U+D
--	--	G	0-0.5 Feet	12/12/91	9066	SS-2	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	12/12/91	9067	SS-3	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	12/12/91	9068	SS-4	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	GD	0-0.5 Feet	12/12/91	9070	SS-4	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	12/14/91	9168	MW-16	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	12/14/91	9169	MW-16	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	6-8 Feet	12/14/91	9170	MW-16	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	12/14/91	9171	MW-15	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	12/14/91	9172	MW-15	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	6-8 Feet	12/14/91	9173	MW-15	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	1/7/92	0164	SB-1	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	1/7/92	0165	SB-1	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	6-8 Feet	1/7/92	0166	SB-1	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	1/7/92	0167	SB-2	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	1/7/92	0168	SB-2	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	6-8 Feet	1/7/92	0169	SB-2	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	1/7/92	0170	SB-3	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	1/7/92	0171	SB-3	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	6-8 Feet	1/7/92	0172	SB-3	20 U+D	20 U+D	20 U+D	20 U+D
--	--	G	0-0.5 Feet	1/7/92	0173	SB-4	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	1/7/92	0174	SB-4	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	6-8 Feet	1/7/92	0175	SB-4	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	GD	0-0.5 Feet	1/7/92	0176	SB-4	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	1/8/92	0177	SB-5	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	1/8/92	0178	SB-5	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	6-8 Feet	1/8/92	0179	SB-5	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	1/8/92	0180	SB-6	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	1/8/92	0181	SB-6	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	6-8 Feet	1/8/92	0182	SB-6	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	1/9/92	0294	SB-7	4.0 U+D	4.0 U+D	4.0 U+D	4.0 U+D

N/S Coor.	E/W Coor.	Sample Type	Depth	Date of Collection	Lab Sample No.	Sample ID	Chloromethane (µg/kg)	Bromomethane (µg/kg)	Vinyl Chloride (µg/kg)	Chloroethane (µg/kg)
--	--	G	2-4 Feet	1/9/92	0295	SB-7	4.0 U+D	4.0 U+D	4.0 U+D	4.0 U+D
--	--	G	6-8 Feet	1/9/92	0296	SB-7	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	1/9/92	0297	SB-8	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	1/9/92	0298	SB-8	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	6-8 Feet	1/9/92	0299	SB-8	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	1/9/92	0300	SB-9	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	1/9/92	0301	SB-9	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	6-8 Feet	1/9/92	0302	SB-9	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	GD	0-0.5 Feet	1/9/92	0303	SB-8	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	1/9/92	0306	SB-10	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	1/9/92	0307	SB-10	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	6-8 Feet	1/9/92	0308	SB-10	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	1/9/92	0309	SB-11	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	1/9/92	0310	SB-11	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	1/10/92	0312	SB-12	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	1/10/92	0313	SB-12	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	6-8 Feet	1/10/92	0314	SB-12	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	1/10/92	0316	SB-13	250 U+	250 U+	250 U+	250 U+
--	--	G	2-4 Feet	1/10/92	0317	SB-13	250 U+	250 U+	250 U+	250 U+
--	--	G	6-8 Feet	1/10/92	0318	SB-13	250 U+	250 U+	250 U+	250 U+
--	--	G	0-0.5 Feet	1/10/92	0319	SB-14	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	1/10/92	0320	SB-14	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	6-8 Feet	1/10/92	0321	SB-14	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	0-0.5 Feet	1/10/92	0322	SB-15	250 U+	250 U+	250 U+	250 U+
--	--	G	2-4 Feet	1/10/92	0323	SB-15	250 U+	250 U+	250 U+	250 U+
--	--	G	6-8 Feet	1/10/92	0324	SB-15	250 U+	250 U+	250 U+	250 U+
--	--	G	0-0.5 Feet	1/10/92	0325	SB-16	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	2-4 Feet	1/10/92	0326	SB-16	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	G	6-8 Feet	1/10/92	0327	SB-16	2.0 U+	2.0 U+	2.0 U+	2.0 U+
--	--	GD	0-0.5 Feet	1/10/92	0328	SB-16	2.0 U+	2.0 U+	2.0 U+	2.0 U+
					Maximum		95	0	0	0
					Minimum		95	0	0	0

Lab Sample No.	Methylene Chloride (µg/kg)	Acetone (µg/kg)	Carbon Disulfide (µg/kg)	1,1-Dichloroethene (µg/kg)	1,1-Dichloroethane (µg/kg)	1,2-Dichloroethene (Total) (µg/kg)	Chloroform (µg/kg)	1,2-Dichloroethane (µg/kg)
5146	250 U+	630 U+	250 U+	250 U+	130 U+	130 U+	130 U+	130 U+
5147	250 U+	630 U+	250 U+	250 U+	130 U+	130 U+	130 U+	130 U+
5148	5.0 U+D	12.5 U+D	5.0 U+D	5.0 U+D	2.5 U+D	2.5 U+D	2.5 U+D	2.5 U+D
9066	2.0 U+	5.0 U+	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
9067	2.0 U+	5.0 U+	2.0 U+	2.0 U+	1.0 U+	3.4 J	1.0 U+	1.0 U+
9068	2.0 U+	5.0 U+	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
9070	2.0 U+	5.0 U+	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
9168	2.0 U+	14000	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
9169	2.0 U+	4300 J	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
9170	2.0 U+	52 J	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
9171	2.0 U+	20000	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
9172	2.0 U+	13000	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
9173	2.0 U+	3000 DE	2.0 U+	2.0 U+	1.0 U+	5.5 J	1.0 U+	1.0 U+
0164	2.0 U+	4400 DE	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0165	2.0 U+	5700 DE	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0166	2.0 U+	890 D	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0167	2.0 U+	17000 DE	2.0 U+	2.0 U+	1.0 U+	21	1.0 U+	1.0 U+
0168	2.0 U+	150	2.0 U+	2.0 U+	1.0 U+	270 E	3.3 J	1.0 U+
0169	2.0 U+	630 E	2.0 U+	2.0 U+	1.0 U+	1500 E	8.3 J	1.0 U+
0170	2.0 U+	18000	2.0 U+	2.0 U+	1.0 U+	210	1.0 U+	1.0 U+
0171	2.0 U+	200 J	2.0 U+	2.0 U+	1.0 U+	590 J	1.0 U+	1.0 U+
0172	20 U+D	980 D	20 U+D	20 U+D	10 U+D	3000 DE	10 U+D	10 U+D
0173	2.0 U+	110	2.0 U+	2.0 U+	1.0 U+	49	1.0 U+	1.0 U+
0174	2.0 U+	3900 E	2.0 U+	2.0 U+	1.0 U+	78	1.0 U+	1.0 U+
0175	2.0 U+	350 E	2.0 U+	2.0 U+	1.0 U+	430 E	9.9 J	1.0 U+
0176	2.0 U+	450 JD	2.0 U+	2.0 U+	1.0 U+	19	1.0 U+	1.0 U+
0177	9.6 JBX+	5.0 U+	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0178	12 JBX+	6300 DE	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0179	2.0 U+	100	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0180	16 JBX+	5500 DE	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0181	6.0 JBX+	13000 DE	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0182	4.5 JBX+	140	2.0 U+	2.0 U+	1.0 U+	3.5 J	1.0 U+	1.0 U+
0294	4.0 U+D	290 D	4.0 U+D	4.0 U+D	2.0 U+D	2.0 U+D	2.0 U+D	2.0 U+D

Lab Sample No.	Methylene Chloride (µg/kg)	Acetone (µg/kg)	Carbon Disulfide (µg/kg)	1,1-Dichloroethene (µg/kg)	1,1-Dichloroethane (µg/kg)	1,2-Dichloroethene (Total) (µg/kg)	Chloroform (µg/kg)	1,2-Dichloroethane (µg/kg)
0295	4.0 U+D	3400 J	4.0 U+D	4.0 U+D	2.0 U+D	2.0 U+D	2.0 U+D	2.0 U+D
0296	2.0 U+	5.0 U+	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0297	2.0 U+	450 JD	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0298	2.0 U+	3800 JBX+	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0299	2.0 U+	5.0 U+	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0300	2.0 U+	1800 D	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0301	2.0 U+	5.0 U+	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0302	2.0 U+	180	2.0 U+	2.0 U+	1.0 U+	6.4 J	1.0 U+	1.0 U+
0303	2.0 U+	5.0 U+	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0306	2.0 U+	37 J	2.0 U+	2.0 U+	1.0 U+	4.7 J	1.0 U+	1.0 U+
0307	2.0 U+	35 J	2.0 U+	2.0 U+	1.0 U+	29	1.0 U+	1.0 U+
0308	2.0 U+	110	2.0 U+	2.0 U+	1.0 U+	41	1.0 U+	1.0 U+
0309	2.0 U+	5.0 U+	2.0 U+	2.0 U+	1.0 U+	28	1.0 U+	1.0 U+
0310	2.0 U+	37 J	2.0 U+	2.0 U+	1.0 U+	15	1.0 U+	1.0 U+
0312	2.0 U+	5.0 U+	2.0 U+	2.0 U+	1.0 U+	30	1.0 U+	1.0 U+
0313	2.0 U+	370 D	2.0 U+	2.0 U+	1.0 U+	57	1.0 U+	1.0 U+
0314	2.0 U+	200	2.0 U+	2.0 U+	1.0 U+	7.4 J	1.0 U+	1.0 U+
0316	250 U+	10000	250 U+	250 U+	130 U+	130 U+	130 U+	130 U+
0317	250 U+	630 U+	250 U+	250 U+	130 U+	360 J	130 U+	130 U+
0318	330 J	1300 J	250 U+	250 U+	130 U+	130 U+	130 U+	130 U+
0319	2.0 U+	110	2.0 U+	2.0 U+	1.0 U+	59	1.0 U+	1.0 U+
0320	2.0 U+	110	2.0 U+	2.0 U+	1.0 U+	12 J	1.0 U+	1.0 U+
0321	2.0 U+	4000 J	2.0 U+	2.0 U+	1.0 U+	54	1.0 U+	1.0 U+
0322	250 U+	630 U+	250 U+	250 U+	130 U+	3500	130 U+	130 U+
0323	250 U+	4800	250 U+	250 U+	130 U+	64000 JD	130 U+	130 U+
0324	250 U+	1200 JBX+	250 U+	250 U+	130 U+	570 J	130 U+	130 U+
0325	2.0 U+	5.0 U+	2.0 U+	2.0 U+	1.0 U+	8.7 J	1.0 U+	1.0 U+
0326	2.0 U+	5.0 U+	2.0 U+	2.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0327	2.0 U+	120	2.0 U+	2.0 U+	1.0 U+	22	1.0 U+	1.0 U+
0328	2.0 U+	5.0 U+	2.0 U+	2.0 U+	1.0 U+	16	1.0 U+	1.0 U+
Maximum	330	20000	0	0	0	64000	9.9	0
Minimum	330	35	0	0	0	3.4	3.3	0

Lab Sample No.	2-Butanone (µg/kg)	1,1,1-Trichloroethane (µg/kg)	Carbon Tetrachloride (µg/kg)	Vinyl Acetate (µg/kg)	Bromodichloromethane (µg/kg)	1,2-Dichloropropane (µg/kg)	1,3-Dichloropropene (Total) (µg/kg)	Trichloroethene (µg/kg)
5146	1200 U+	130 U+	130 U+	130 U+	130 U+	130 U+	130 U+	130 U+
5147	1200 U+	130 U+	130 U+	130 U+	130 U+	130 U+	130 U+	130 U+
5148	25 U+D	2.5 U+D	2.5 U+D	2.5 U+D	2.5 U+D	2.5 U+D	2.5 U+D	2.5 U+D
9066	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
9067	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2400 D
9068	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	46
9070	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	54
9168	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
9169	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
9170	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
9171	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
9172	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
9173	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0164	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	16
0165	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	18
0166	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	122
0167	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	90
0168	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	5400
0169	370 E	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	470000 D
0170	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	10000
0171	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	10000
0172	100 U+D	10 U+D	10 U+D	10 U+D	10 U+D	10 U+D	10 U+D	270000 D
0173	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	5400000 D
0174	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	18000
0175	250 E	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	250000 D
0176	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	30000
0177	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	5600
0178	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	170
0179	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	87
0180	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	12 J
0181	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	92
0182	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	260
0294	20 U+D	2.0 U+D	2.0 U+D	2.0 U+D	2.0 U+D	2.0 U+D	2.0 U+D	86 D

Lab Sample No.	2-Butanone (µg/kg)	1,1,1-Trichloroethane (µg/kg)	Carbon Tetrachloride (µg/kg)	Vinyl Acetate (µg/kg)	Bromodichloromethane (µg/kg)	1,2-Dichloropropane (µg/kg)	1,3-Dichloropropene (Total) (µg/kg)	Trichloroethene (µg/kg)
0295	20 U+D	2.0 U+D	2.0 U+D	2.0 U+D	2.0 U+D	2.0 U+D	2.0 U+D	270 D
0296	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	47
0297	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	4.4 JBX+
0298	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	8.0 J
0299	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+
0300	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	4.5 JBX+
0301	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	34
0302	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	7.9 J
0303	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	4.2 J
0306	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	46
0307	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	96
0308	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	99
0309	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	59
0310	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	65
0312	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	130
0313	32 J	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	300 D
0314	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	12 J
0316	1200 U+	130 U+	130 U+	130 U+	130 U+	130 U+	130 U+	350 J
0317	1200 U+	130 U+	130 U+	130 U+	130 U+	130 U+	130 U+	130 U+
0318	1200 U+	130 U+	130 U+	130 U+	130 U+	130 U+	130 U+	20000
0319	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	93
0320	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	35
0321	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	29
0322	1200 U+	130 U+	130 U+	130 U+	130 U+	130 U+	130 U+	8900
0323	1200 U+	130 U+	130 U+	130 U+	130 U+	130 U+	130 U+	1500000 D
0324	1200 U+	130 U+	130 U+	130 U+	130 U+	130 U+	130 U+	11000
0325	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	66
0326	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	28
0327	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	55
0328	10 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	76
Maximum	370	0	0	0	0	0	0	5400000
Minimum	32	0	0	0	0	0	0	4.2

Lab Sample No.	Dibromochloromethane (µg/kg)	1,1,2-Trichloroethane (µg/kg)	Benzene (µg/kg)	Trichlorofluoromethane (µg/kg)	2-Chloroethylvinyl ether (µg/kg)	Bromoform (µg/kg)	4-Methyl-2-Pentanone (µg/kg)	2-Hexanone (µg/kg)
5146	130 U+	130 U+	130 U+	250 U+	130 U+	130 U+	250 U+	250 U+
5147	130 U+	130 U+	130 U+	250 U+	130 U+	130 U+	250 U+	250 U+
5148	2.5 U+D	2.5 U+D	2.5 U+D	5.0 U+D	2.5 U+D	2.5 U+D	5.0 U+D	5.0 U+D
9066	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
9067	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
9068	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
9070	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
9168	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
9169	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
9170	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
9171	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
9172	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
9173	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0164	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0165	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0166	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0167	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0168	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0169	1.0 U+	30	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0170	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	25	19 J
0171	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0172	10 U+D	2300	10 U+D	20 U+D	10 U+D	10 U+D	20 U+D	20 U+D
0173	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0174	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0175	1.0 U+	43	1.0 U+	2.0 U+	1.0 U+	1.0 U+	5.2 J	2.0 U+
0176	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0177	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0178	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0179	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0180	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0181	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0182	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0294	2.0 U+D	2.0 U+D	2.0 U+D	4.0 U+D	2.0 U+D	2.0 U+D	4.0 U+D	4.0 U+D

Lab Sample No.	Dibromochloromethane (µg/kg)	1,1,2-Trichloroethane (µg/kg)	Benzene (µg/kg)	Trichlorofluoromethane (µg/kg)	2-Chloroethylvinyl ether (µg/kg)	Bromoform (µg/kg)	4-Methyl-2-Pentanone (µg/kg)	2-Hexanone (µg/kg)
0295	2.0 U+D	2.0 U+D	2.0 U+D	4.0 U+D	2.0 U+D	2.0 U+D	4.0 U+D	4.0 U+D
0296	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0297	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0298	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0299	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0300	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0301	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0302	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0303	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0306	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0307	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0308	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0309	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0310	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0312	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0313	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0314	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0316	130 U+	130 U+	130 U+	250 U+	130 U+	130 U+	250 U+	250 U+
0317	130 U+	130 U+	130 U+	250 U+	130 U+	130 U+	250 U+	250 U+
0318	130 U+	130 U+	130 U+	250 U+	130 U+	130 U+	250 U+	250 U+
0319	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0320	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0321	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0322	130 U+	130 U+	130 U+	250 U+	130 U+	130 U+	250 U+	250 U+
0323	130 U+	1100 J	130 U+	250 U+	130 U+	130 U+	250 U+	250 U+
0324	130 U+	130 U+	130 U+	250 U+	130 U+	130 U+	250 U+	250 U+
0325	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0326	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0327	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
0328	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+	1.0 U+	2.0 U+	2.0 U+
Maximum	0	2300	0	0	0	0	25	19
Minimum	0	30	0	0	0	0	5.2	19

Lab Sample No.	Tetrachloroethene (µg/kg)	1,1,2,2-Tetrachloro-ethane (µg/kg)	Toluene (µg/kg)	Chlorobenzene (µg/kg)	Ethyl Benzene (µg/kg)	Styrene (µg/kg)	Xylene (Total) (µg/kg)	1,2-Dichlorobenzene (µg/kg)
5146	130 U+	130 U+	2700 J	130 U+	13000 J	130 U+	75000 JD	130 U+
5147	130 U+	130 U+	3900 J	130 U+	17000 J	130 U+	93000 JD	130 U+
5148	2.5 U+D	2.5 U+D	2.5 U+D	2.5 U+D	2.5 U+D	2.5 U+D	29 JD	2.5 U+D
9066	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
9067	4.6 J	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
9068	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
9070	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
9168	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
9169	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
9170	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
9171	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
9172	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
9173	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0164	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0165	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0166	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0167	5.6 J	7.6 J	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0168	240	870 J	4000	1.0 U+	5700	1.0 U+	31000 E	1.0 U+
0169	3.4 J	14	230	1.0 U+	51	1.0 U+	200	1.0 U+
0170	1.0 U+	1.0 U+	4.2 J	1.0 U+	6.3 J	1.0 U+	3.2 J	1.0 U+
0171	1300 J	110	3100	1.0 U+	1500 J	1.0 U+	7800	1.0 U+
0172	5900	28 JD	84000 D	10 U+D	14000	10 U+D	66000	10 U+D
0173	170	9.5 J	260 J	1.0 U+	250	1.0 U+	860 E	1.0 U+
0174	680 J	130	460 J	1.0 U+	910 J	1.0 U+	4500	1.0 U+
0175	4.7 J	3.4 J	160	1.0 U+	33	1.0 U+	120	1.0 U+
0176	5.6 J	8.6 J	7.0 J	1.0 U+	1.0 U+	1.0 U+	3.3 J	1.0 U+
0177	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0178	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0179	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0180	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0181	1.0 U+	1.0 U+	4.9 JBX+	1.0 U+	1.0 U+	1.0 U+	20 J	1.0 U+
0182	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0294	2.0 U+D	2.0 U+D	2.0 U+D	2.0 U+D	2.0 U+D	2.0 U+D	4.0 U+D	2.0 U+D

Lab Sample No.	Tetrachloroethene (µg/kg)	1,1,2,2-Tetrachloro-ethane (µg/kg)	Toluene (µg/kg)	Chlorobenzene (µg/kg)	Ethyl Benzene (µg/kg)	Styrene (µg/kg)	Xylene (Total) (µg/kg)	1,2-Dichlorobenzene (µg/kg)
0295	2.0 U+D	2.0 U+D	4.8 JD	2.0 U+D	2.0 U+D	2.0 U+D	4.0 U+D	2.0 U+D
0296	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0297	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0298	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0299	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0300	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	3.4 J	1.0 U+
0301	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0302	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0303	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0306	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0307	1.0 U+	1.0 U+	5.8 J	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0308	1.0 U+	1.0 U+	6.2 J	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0309	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0310	2.0 J	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0312	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0313	1.0 U+	1.0 U+	49	1.0 U+	160	1.0 U+	880 D	1.0 U+
0314	1.0 U+	1.0 U+	4.4 J	1.0 U+	1.0 U+	1.0 U+	7.0 J	1.0 U+
0316	130 U+	130 U+	520 JBX+	130 U+	360 J	130 U+	11000	130 U+
0317	130 U+	130 U+	870 JBX+	130 U+	3400	130 U+	16000	130 U+
0318	130 U+	130 U+	400 JBX+	130 U+	130 U+	130 U+	220 J	130 U+
0319	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0320	1.0 U+	1.0 U+	3.4 J	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0321	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0322	130 U+	130 U+	170 JBX+	130 U+	130 U+	130 U+	250 U+	130 U+
0323	130 U+	130 U+	75000 JBDX+	130 U+	11000	130 U+	28000 JD	130 U+
0324	130 U+	130 U+	1100 JBX+	130 U+	130 U+	130 U+	1600 J	130 U+
0325	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0326	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
0327	1.0 U+	1.0 U+	7.2 J	1.0 U+	1.0 U+	1.0 U+	14 J	1.0 U+
0328	1.0 U+	1.0 U+	3.1 J	1.0 U+	1.0 U+	1.0 U+	2.0 U+	1.0 U+
Maximum	5900	870	84000	0	17000	0	93000	0
Minimum	2	3.4	3.1	0	6.3	0	3.2	0

Lab Sample No.	1,3-Dichlorobenzene (µg/kg)	1,4-Dichlorobenzene (µg/kg)
5146	130 U+	130 U+
5147	130 U+	130 U+
5148	2.5 U+D	2.5 U+D
9066	1.0 U+	1.0 U+
9067	1.0 U+	1.0 U+
9068	1.0 U+	1.0 U+
9070	1.0 U+	1.0 U+
9168	1.0 U+	1.0 U+
9169	1.0 U+	1.0 U+
9170	1.0 U+	1.0 U+
9171	1.0 U+	1.0 U+
9172	1.0 U+	1.0 U+
9173	1.0 U+	1.0 U+
0164	1.0 U+	1.0 U+
0165	1.0 U+	1.0 U+
0166	1.0 U+	1.0 U+
0167	1.0 U+	1.0 U+
0168	1.0 U+	1.0 U+
0169	1.0 U+	1.0 U+
0170	1.0 U+	1.0 U+
0171	1.0 U+	1.0 U+
0172	10 U+D	10 U+D
0173	1.0 U+	1.0 U+
0174	1.0 U+	1.0 U+
0175	1.0 U+	1.0 U+
0176	1.0 U+	1.0 U+
0177	1.0 U+	1.0 U+
0178	1.0 U+	1.0 U+
0179	1.0 U+	1.0 U+
0180	1.0 U+	1.0 U+
0181	1.0 U+	1.0 U+
0182	1.0 U+	1.0 U+
0294	2.0 U+D	2.0 U+D

Lab Sample No.	1,3-Dichlorobenzene (µg/kg)	1,4-Dichlorobenzene (µg/kg)
0295	2.0 U+D	2.0 U+D
0296	1.0 U+	1.0 U+
0297	1.0 U+	1.0 U+
0298	1.0 U+	1.0 U+
0299	1.0 U+	1.0 U+
0300	1.0 U+	1.0 U+
0301	1.0 U+	1.0 U+
0302	1.0 U+	1.0 U+
0303	1.0 U+	1.0 U+
0306	1.0 U+	1.0 U+
0307	1.0 U+	1.0 U+
0308	1.0 U+	1.0 U+
0309	1.0 U+	1.0 U+
0310	1.0 U+	1.0 U+
0312	1.0 U+	1.0 U+
0313	1.0 U+	1.0 U+
0314	1.0 U+	1.0 U+
0316	130 U+	130 U+
0317	130 U+	130 U+
0318	130 U+	130 U+
0319	1.0 U+	1.0 U+
0320	1.0 U+	1.0 U+
0321	1.0 U+	1.0 U+
0322	130 U+	130 U+
0323	130 U+	130 U+
0324	130 U+	130 U+
0325	1.0 U+	1.0 U+
0326	1.0 U+	1.0 U+
0327	1.0 U+	1.0 U+
0328	1.0 U+	1.0 U+
Maximum	0	0
Minimum	0	0

INTERIM ACTIONS: ROCKWELL - SOILS (SEMIVOLATILES)

ON-SITE 4/29/93 3:19 PM

N/S Coor.	E/W Coor.	Sample Type	Depth	Date of Collection	Lab Sample No.	Sample ID	Acenaphthene (mg/kg)	Acenaphthylene (mg/kg)	Anthracene (mg/kg)	Benzidine (mg/kg)
--	--	GD	0-0.5 Feet	8/8/91	5146	SAB-2	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
--	--	G	0-0.5 Feet	8/8/91	5147	SAB-2	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
--	--	G	0-0.5 Feet	8/8/91	5148	SAB-3	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
					Maximum		0	0	0	0
					Minimum		0	0	0	0

Lab Sample No.	Benzyl Alcohol (mg/kg)	Benzo(a)anthracene (mg/kg)	Benzo(a)pyrene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Benzo(ghi)perylene (mg/kg)	Benzo(k)fluoranthene (mg/kg)	bis(2-Chloroethoxy)-methane (mg/kg)	bis(2-Chloroethyl)-ether (mg/kg)
5146	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
5147	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
5148	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
Maximum	0	0	0	0	0	0	0	0
Minimum	0	0	0	0	0	0	0	0

Lab Sample No.	bis(2-Chloroisopropyl)-ether (mg/kg)	bis(2-Ethylhexyl)-phthalate (mg/kg)	4-Bromophenyl-phenyl ether (mg/kg)	Butyl benzyl phthalate (mg/kg)	2-Chloronaphthalene (mg/kg)	4-Chlorophenyl-phenyl ether (mg/kg)	Chrysene (mg/kg)	Dibenzo(a,h)anthracene (mg/kg)
5146	0.7 U+D	0.9 JBDX+	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
5147	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
5148	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
Maximum	0	0	0	0	0	0	0	0
Minimum	0	0	0	0	0	0	0	0

Lab Sample No.	3,3-Dichlorobenzidine (mg/kg)	Diethyl phthalate (mg/kg)	Dimethyl phthalate (mg/kg)	Di-n-butyl phthalate (mg/kg)	2,4-Dinitrotoluene (mg/kg)	2,6-Dinitrotoluene (mg/kg)	Di-n-octyl phthalate (mg/kg)	1,2-Diphenylhydrazine (mg/kg)
5146	0.7 U+D	0.7 U+D	0.7 U+D	0.6 JBDX+	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
5147	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
5148	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
Maximum	0	0	0	0	0	0	0	0
Minimum	0	0	0	0	0	0	0	0

Lab Sample No.	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Hexachlorobenzene (mg/kg)	Hexachlorobutadiene (mg/kg)	Hexachloro-cyclopentadiene (mg/kg)	Hexachloroethane (mg/kg)	Indeno(1,2,3-cd)pyrene (mg/kg)	Isophorone (mg/kg)
5146	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
5147	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
5148	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
Maximum	0	0	0	0	0	0	0	0
Minimum	0	0	0	0	0	0	0	0

Lab Sample No.	Naphthalene (mg/kg)	Nitrobenzene (mg/kg)	n-Nitrosodi-methylamine (mg/kg)	n-Nitrosodi-n-propylamine (mg/kg)	n-Nitrosodi-phenylamine (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)	1,2,4-Trichlorobenzene (mg/kg)
5146	3.6 JD	0.7 U+D	0.7 U+D	3.3 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
5147	2.0 JD	0.7 U+D	0.7 U+D	3.3 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
5148	0.7 U+D	0.7 U+D	0.7 U+D	3.3 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
Maximum	3.6	0	0	0	0	0	0	0
Minimum	2	0	0	0	0	0	0	0

Lab Sample No.	4-Chloroaniline (mg/kg)	2-Methylnaphthalene (mg/kg)	2-Chloronaphthalene (mg/kg)	2-Nitroaniline (mg/kg)	3-Nitroaniline (mg/kg)	Dibenzofuran (mg/kg)	4-Nitroaniline (mg/kg)	2-Chlorophenol (mg/kg)
5146	1.5 U+D	6.5 JD	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
5147	1.5 U+D	3.6 JD	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
5148	1.5 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
Maximum	0	6.5	0	0	0	0	0	0
Minimum	0	3.6	0	0	0	0	0	0

Lab Sample No.	2,4-Dichlorophenol (mg/kg)	2,4-Dimethylphenol (mg/kg)	4,6-Dinitro-2-methylphenol (mg/kg)	2,4-Dinitrophenol (mg/kg)	2-Nitrophenol (mg/kg)	4-Nitrophenol (mg/kg)	4-Chloro-3-methylphenol (mg/kg)	Pentachlorophenol (mg/kg)
5146	0.7 U+D	0.7 U+D	3.5 U+D	14 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
5147	0.7 U+D	0.7 U+D	3.5 U+D	14 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
5148	0.7 U+D	0.7 U+D	3.5 U+D	14 U+D	0.7 U+D	0.7 U+D	0.7 U+D	0.7 U+D
Maximum	0	0	0	0	0	0	0	0
Minimum	0	0	0	0	0	0	0	0

Lab Sample No.	Phenol (mg/kg)	2,4,6-Trichlorophenol (mg/kg)	2-Methylphenol (mg/kg)	4-Methylphenol (mg/kg)	Benzoic Acid (mg/kg)	2,4,5-Trichlorophenol (mg/kg)
5146	0.7 U+D	0.7 U+D	3.5 U+D	3.5 U+D	1.8 U+D	3.5 U+D
5147	0.7 U+D	0.7 U+D	3.5 U+D	3.5 U+D	1.8 U+D	3.5 U+D
5148	0.7 U+D	0.7 U+D	3.5 U+D	3.5 U+D	1.8 U+D	3.5 U+D
Maximum	0	0	0	0	0	0
Minimum	0	0	0	0	0	0

NOTES AND QUALIFIERS FOR THE ANALYTICAL DATA

Maximum and minimum values in the preceding tables are based on detected values only (those not qualified with a "+"). Maximum and minimum values of zero (0) for a compound indicate that the compound was not detected.

U = The presence of a "U" indicates that the compound was analyzed for but was not detected.

B = The presence of a "B" to the right of an analytical value indicates that this compound was also detected in the method blank and the data should be interpreted with caution. One should consider the possibility that the correct sample result might be less than the reported result and, perhaps, zero.

D = When a sample (or sample extract) is rerun diluted because one of the compound concentrations exceeded the highest concentration range for the standard curve, all of the values obtained in the dilution run will be flagged with a "D".

E = The concentration for any compound found which exceeds the highest concentration level on the standard curve for that compound will be flagged with an "E". Usually, the sample will be rerun at a dilution to quantitate the flagged compound.

J = The presence of a "J" to the right of an analytical result indicates that the reported result in estimated. The mass spectral data pass the identification criteria showing that the compound is present, but the calculated result is less than the practical quantitation limit (PQL). One should feel confident that the result is greater than zero and less than the PQL. The "J" qualifier may also be used to indicate that some aspect of quality control was not within acceptable limits.

X = The presence of a "X" to the right of an analytical result indicates that the result was eliminated during the comparison to laboratory or field blanks associated with that sample.

+ = The presence of a "+" to the right of an analytical result indicates that the result was not used in determining the maximum and minimum values for that compound.

APPENDIX B

MODELING OF THE VOLATILIZATION FACTOR FOR USE IN THE INHALATION EXPOSURE ROUTE

ESTIMATION OF AIRBORNE CONCENTRATIONS OF SOIL CONSTITUENTS

This section deals with the methodology used to estimate airborne concentrations of the soil constituents. Only the volatilization pathway was considered for the transfer of constituents from soils to air as all of the constituents of interest are volatile or semivolatile organic compounds. This pathway is discussed in *Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals)*, Office of Emergency and Remedial Response, USEPA Publication 9285.7-01B, December 1991, hereafter referred to as the Risk Assessment Guidance Manual.

Volatilization Pathway. The volatilization pathway is of significance for volatile soil constituents. The constituents volatilize directly into the air in contact with the soil and thus enter the air medium. The propensity of a constituent to volatilize is assumed to depend on the Henry's Law Constant and the molecular weight of the constituent. In fact, this pathway is considered to be significant only for constituents with Henry's Law Constant greater than or equal to 1×10^{-5} atm-m^3/gmol and molecular weight less than 200 g/gmol as discussed in the Risk Assessment Guidance Manual. Only if *both* of these conditions are satisfied is volatilization considered to be a pathway for the transfer of constituents from soil to air. The equation used to calculate the Volatilization Factor (VF) is taken from the Risk Assessment Guidance Manual and is as follows:

SOIL-TO-AIR VOLATILIZATION FACTOR

$$VF\ (m^3/kg) = \frac{(LS \times V \times DH)}{A} \times \frac{(3.14 \times \alpha \times T)^{1/2}}{(2 \times D_{ei} \times E \times K_{as} \times 10^{-3}\ kg/g)}$$

where:

$$\alpha\ (cm^2/s) = \frac{(D_{ei} \times E)}{E + (p_s)(1-E)/K_{as}}$$

Standard default parameter values that can be used to reduce Equation (8) are listed below. These represent "typical" values as identified in a number of sources. For example, when site-specific values are not available, the length of a side of the contaminated area (LS) is assumed to be 45 m; this is based on a contaminated area of 0.5 acre which approximates the size of an average residential lot. The "typical" values LS, DH, and V are from EPA 1986. "Typical" values for E, OC, and p_s are from EPA 1984, EPA 1988b, and EPA 1988f. Site-specific data should be substituted for the default values listed below wherever possible. Standard values for chemical-specific D_i, H, and K_{oc} can be obtained by calling the Superfund Health Risk Technical Support Center.

Parameter	Definition (units)	Default
VF	volatilization factor (m^3/kg)	—
LS	length of side of contaminated area (m)	45 m
V	wind speed in mixing zone (m/s)	2.25 m/s
DH	diffusion height (m)	2 m
A	area of contamination (cm^2)	20,250,000 cm^2
D_{ei}	effective diffusivity (cm^2/s)	$D_i \times E^{0.33}$
E	true soil porosity (unitless)	0.35
K_{as}	soil/air partition coefficient (g soil/cm^3 air)	(H/K_d) x 41, where 41 is a units conversion factor
p_s	true soil density or particulate density (g/cm^3)	2.65 g/cm^3
T	exposure interval (s)	7.9×10^8 s
D_i	molecular diffusivity (cm^2/s)	chemical-specific
H	Henry's law constant ($atm\text{-}m^3/mol$)	chemical-specific
K_d	soil-water partition coefficient (cm^3/g)	chemical-specific, or K_{oc} x OC
K_{oc}	organic carbon partition coefficient (cm^3/g)	chemical-specific
OC	organic carbon content of soil (fraction)	site-specific, or 0.02

Whenever possible, site-specific values of the parameters in the VF equation were used to calculate VF; if site-specific information was not available, default values were used. The site-specific values of parameters used in the calculation of VF are listed below:

A = The area of the on-site landfill was estimated from the site map (Figure 1) to be 18,850 m^2.

LS = LS is the length of the side of the site that is normal to the wind direction. For this site, a site-wide average LS of 137.3 m (square root of the area) was assumed.

T = The exposure interval was calculated based on the Exposure Time (ET, hr/day), Exposure Frequency (EF, days/yr) and the Exposure Duration (ED, years).

D_i = The molecular diffusivities of constituents in air at 25°C were estimated using the Wilke-Lee modification of the Hirshfelder-Bird-Spotz method as outlined in *Mass Transfer Operations*, by Robert E. Treybal, McGraw Hill (1981).

H = The Henry's Law Constants were obtained from *Groundwater Chemicals Desk Reference* by J. H. Montgomery and L. M. Welkom, Lewis Publishers (1990) except for 2-methylnaphthalene which was obtained from *Hazardous Waste Treatment, Storage and Disposal Facilities (TSDF) - Air Emission Models*, USEPA Report No. EPA-450/3-87-026, 1987. If available, the values of Henry's Law Constants at 20-25°C were used in the VF calculations.

The "actual" parameters presented in Table 1 were used in the determination of the constituent-specific VFs, which are presented in Table 2.

Airborne Concentrations

After calculating the Volatilization Factor (VF), the airborne concentration of a constituent is calculated as follows:

$C_{Air} = C_{soil} \times (1/VF)$

Discussion

The estimation of airborne concentrations involves a number of assumptions which are conservative in nature. The effect of temperature has not been accounted for in the calculation of VF. The calculation has been performed for a temperature of 25°C which may not be the normal average annual temperature of the site. Thus the airborne concentrations predicted by these estimation techniques are conservative and probably yield worst-case predictions.

TABLE 1

CALCULATION OF VOLATILIZATION FACTOR AT ROCKWELL SITE		
Parameter	Default	Actual
LS, Length of side of contaminated area (m)	45	137.2938455
V, Wind speed in mixing zone (m/s)	2.25	2.25
DH, Diffusion height, m	2	2
A, Area of contamination (sq. m)	2025	18849.6
E, True soil porosity (unitless)	0.35	0.35
ps, true soil density, g/cc	2.65	2.65
T, exposure interval, s	790000000	18000000
G, fraction of vegetative cover (unitless)	0	0
OC, Soil organic carbon content (fraction)	0.02	0.02

TABLE 2

CALCULATION OF VOLATILIZATION FACTORS FOR USE IN INTERIM TARGET CLEANUP LEVEL CALCULATIONS

OCCUPATIONAL MAINTENANCE WORKER POPULATION

Constituent	Molecular Wt. (g/mol)	Diffusivity (cm2/s)	Henry's Law const. (atm-m3/mol)	Kd cc/g	Koc cc/g	Dei cm2/s	Kas g/cc	alpha cm2/s	VF m3/kg
Acetone	58.1	0.11	3.97E-05	7.4E-03	0.37	7.8E-02	2.2E-01	3.3E-03	1.2E+02
2-Butanone	72.1	0.10	4.7E-05	2.4E-02	1.2	7.1E-02	8.0E-02	1.1E-03	2.1E+02
Chloroform	119.4	0.08	2.9E-03	6.8E-01	33.9	5.7E-02	1.7E-01	1.9E-03	1.6E+02
Chloromethane	50.5	0.14	1.0E-02	5.0E-01	25.1	9.9E-02	8.2E-01	1.4E-02	5.1E+01
1,2-Dichloroethene (total)	96.9	0.10	6.7E-03	1.2E+00	58.9	7.1E-02	2.3E-01	3.2E-03	1.2E+02
Ethyl benzene	106.2	0.08	6.6E-03	1.9E+00	95.5	5.7E-02	1.4E-01	1.6E-03	1.8E+02
2-Hexanone	100.2	0.08	1.8E-03	2.7E+00	134.9	5.7E-02	3.0E-02	3.0E-04	3.6E+02
Methylene chloride	84.9	0.11	2.2E-03	1.7E-01	8.7	7.8E-02	5.3E-01	7.6E-03	7.4E+01
2-Methylnaphthalene	142.2	0.07	NA	1.6E+02	7943.3	5.0E-02	NA	NA	NA
4-Methyl-2-pentanone	100.2	0.08	1.5E-05	1.2E-01	6.2	5.7E-02	1.0E-02	1.0E-04	6.2E+02
Naphthalene	128.2	0.07	4.6E-04	1.1E+01	549.5	5.0E-02	1.7E-03	1.7E-05	1.7E+03
1,1,2,2-Tetrachloroethane	167.9	0.07	4.6E-04	9.2E-01	46.0	5.0E-02	2.0E-02	2.0E-04	5.0E+02
Tetrachloroethene	165.8	0.08	1.5E-02	4.2E+00	209.9	5.7E-02	1.5E-01	1.7E-03	1.7E+02
Toluene	92.1	0.09	6.7E-03	7.4E-01	37.2	6.4E-02	3.7E-01	4.5E-03	1.0E+02
1,1,2-Trichloroethane	133.4	0.10	7.4E-04	1.1E+00	56.2	7.1E-02	3.0E-02	4.0E-04	3.3E+02
Trichloroethene	131.4	0.09	9.1E-03	1.3E+00	64.6	6.4E-02	2.9E-01	3.6E-03	1.1E+02
Xylene (total)	106.17	0.08	5.3E-03	2.6E+00	128.8	5.7E-02	8.4E-02	1.0E-03	2.3E+02

NA = Not available

APPENDIX C

USEPA REGION IV GUIDANCE:
TOXICITY INFORMATION FOR TRICHLOROETHENE (TCE)

SUBJECT: Toxicity and carcinogenicity of trichloroethylene CAS #79-01-6 (Cecil Field Naval Air Station Site/Jacksonville, Florida)

FROM: Joan S. Dollarhide
Associate Director
Superfund Health Risk Technical Support Center
Chemical Mixtures Assessment Branch

TO: Elmer Akin
U.S. EPA
Region IV

This memo is in response to a request from Michelle Silkowski of ABB Environmental Services for toxicity and carcinogenicity information on trichloroethylene (TCE).

The attached carcinogenicity information has been provided by the Office of Health and Environmental Assessment (OHEA). Any questions regarding this information should be directed to Jeanette Wiltse of OHEA at (202) 260-7315 or Charles Ris of the Human Health Assessment Group/OHEA at (202) 260-5898.

Also, please note that the provisional oral RfD for TCE provided in the attachment has not been through the Agency's review process and therefore does not represent an Agency verified risk assessment.

If you need further assistance please contact the Superfund Technical Support Center at (513) 569-7300.

cc: J. Dinan (OS-230)
B. Means (OS-230)
K. Poirier (ECAO-Cin)
M. Silkowski (ABB Env. Services)

Attachment I

Risk Assessment Issue Paper for: Carcinogenicity of Trichloroethylene (CAS #79-01-6)

The current phase of the carcinogenicity characterization for trichloroethylene started with a July 1985 Health Assessment Document for Trichloroethylene, EPA# 600/8-82/006F which classified trichloroethylene in Weight-of-Evidence Group "B2 - Probable Human Carcinogen". Inhalation and oral upper bound risk estimates were provided. This information was verified on IRIS from 3/87 through 7/89. A June 1987 Addendum to the Health Assessment Document for Trichloroethylene, EPA# 600/8-82/006FA proposed that the Weight-of-Evidence finding of "B2" was further supported by newly available animal bioassay data and offered a minor revision to the inhalation upper bound risk estimate. In 1988 the Agency's Science Advisory Board offered an opinion that the weight-of-evidence was on C-B2 continuum (C=Possible Human Carcinogen, B2=Probable Human Carcinogen). The Agency withdrew the IRIS carcinogenicity file in 7/89 and has not adopted a current position on the weight-of-evidence classification.

The quantitative risk estimates provided in the 1985 Health Assessment Document and 1987 Addendum have been reviewed by the IRIS-Crave Workgroup but are not verified as such pending resolution of the weight-of-evidence classification. The upper bound risk values in these documents are as follows:

ORAL: 1985 HAD; Unit Risk = 3.2E-7 per ug/L
Slope Factor = 1.1E-2 per mg/kg/day

INHALATION: 1987 Addendum; Unit Risk = 1.7E-6 per ug/cu.m.
Slope Factor = 6.0E-3 per mg/kg/day

When the Agency adopts a current position on weight-of-evidence classification, the trichloroethylene file will be reentered on IRIS.

APPENDIX D

INTERMEDIATE CALCULATIONS FOR INTERIM TARGET CLEANUP LEVELS

MDEQ METHOD INTERIM TARGET CLEANUP LEVELS

(CARCINOGENIC)

Constituent	C CS (mg/kg)	CF (g/kg)	W (kg)	I (g/day)	Oral Slope Factor (SF) 1/(mg/kg-day)	Risk Level (R)
Acetone	--	1000	70	0.1	--	1.0E-06
2-Butanone	--	1000	70	0.1	--	1.0E-06
Chloroform	1.1E+02	1000	70	0.1	0.0061	1.0E-06
Chloromethane	5.4E+02	1000	70	0.1	0.013	1.0E-05
1,2-Dichloroethene (cis)	--	1000	70	0.1	--	1.0E-06
1,2-Dichloroethene (trans)	--	1000	70	0.1	--	1.0E-06
Ethyl benzene	--	1000	70	0.1	--	1.0E-06
2-Hexanone	--	1000	70	0.1	--	1.0E-06
Methylene chloride	9.3E+01	1000	70	0.1	0.0075	1.0E-06
2-Methylnaphthalene	--	1000	70	0.1	--	1.0E-06
4-Methyl-2-pentanone	--	1000	70	0.1	--	1.0E-06
Naphthalene	--	1000	70	0.1	--	1.0E-06
1,1,2,2-Tetrachloroethane	3.5E+01	1000	70	0.1	0.2	1.0E-05
Tetrachloroethene	--	1000	70	0.1	--	1.0E-06
Toluene	--	1000	70	0.1	--	1.0E-06
1,1,2-Trichloroethane	1.2E+02	1000	70	0.1	0.057	1.0E-05
Trichloroethene	6.4E+01	1000	70	0.1	0.011	1.0E-06
Xylene (total)	--	1000	70	0.1	--	1.0E-06

MDEQ METHOD INTERIM TARGET CLEANUP LEVELS

(NONCARCINOGENIC)

Constituent	NC CS (mg/kg)	CF (g/kg)	W (kg)	I (g/day)	Oral Reference Dose (RfD) (mg/kg-day)
Acetone	8.0E+03	1000	16	0.2	0.1
2-Butanone	4.0E+03	1000	16	0.2	0.05
Chloroform	8.0E+02	1000	16	0.2	0.01
Chloromethane	--	1000	16	0.2	--
1,2-Dichloroethene (cis)	8.0E+02	1000	16	0.2	0.01
1,2-Dichloroethene (trans)	1.6E+03	1000	16	0.2	0.02
Ethyl benzene	8.0E+03	1000	16	0.2	0.1
2-Hexanone	--	1000	16	0.2	--
Methylene chloride	4.8E+03	1000	16	0.2	0.06
2-Methylnaphthalene	--	1000	16	0.2	--
4-Methyl-2-pentanone	4.0E+03	1000	16	0.2	0.05
Naphthalene	--	1000	16	0.2	--
1,1,2,2-Tetrachloroethane	--	1000	16	0.2	--
Tetrachloroethene	8.0E+02	1000	16	0.2	0.01
Toluene	1.6E+04	1000	16	0.2	0.2
1,1,2-Trichloroethane	3.2E+02	1000	16	0.2	0.004
Trichloroethene	--	1000	16	0.2	--
Xylene (total)	1.6E+05	1000	16	0.2	2

INTERIM TARGET CLEANUP LEVEL CALCULATIONS FOR DERMAL CONTACT WITH AND INCIDENTAL INGESTION OF ON-SITE SOIL

RECREATIONAL/TRESPASSER POPULATION

Constituent	C CS (mg/kg)	NC CS (mg/kg)	CF (kg/mg)	DF (cm^2/kg)	AF (mg/cm^2)	ABS (unitless)	NC AT (days)	C AT (days)	IF (mg/kg)	FI (unitless)	Oral Slope Factor (SF) c 1/(mg/kg-day)	Oral Reference Dose (RfD) c (mg/kg-day)	Target Risk (TR)	Target Hazard Index (THI)
Acetone	--	2.8E+05	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	--	0.1	1.0E-06	1
2-Butanone	--	1.4E+05	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	--	0.05	1.0E-06	1
Chloroform	1.1E+03	2.8E+04	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	0.0061	0.01	1.0E-06	1
Chloromethane	5.0E+02	--	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	0.013	--	1.0E-06	1
1,2-Dichloroethene (cis)	--	2.8E+04	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	--	0.01	1.0E-06	1
1,2-Dichloroethene (trans)	--	5.6E+04	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	--	0.02	1.0E-06	1
Ethyl benzene	--	2.8E+05	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	--	0.1	1.0E-06	1
2-Hexanone	--	--	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	--	--	1.0E-06	1
Methylene chloride	8.7E+02	1.7E+05	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	0.0075	0.06	1.0E-06	1
2-Methylnaphthalene	--	--	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	--	--	1.0E-06	1
4-Methyl-2-pentanone	--	1.4E+05	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	--	0.05	1.0E-06	1
Naphthalene	--	--	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	--	--	1.0E-06	1
1,1,2,2-Tetrachloroethane	3.3E+01	--	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	0.2	--	1.0E-06	1
Tetrachloroethene	--	2.8E+04	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	--	0.01	1.0E-06	1
Toluene	--	5.6E+05	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	--	0.2	1.0E-06	1
1,1,2-Trichloroethane	1.1E+02	1.1E+04	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	0.057	0.004	1.0E-06	1
Trichloroethene	6.0E+02	--	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	0.011	--	1.0E-06	1
Xylene (total)	--	5.6E+06	1.0E-06	121734	1.0	0.01	10950	25550	2681	1.0	--	2	1.0E-06	1

INTERIM TARGET CLEANUP LEVEL CALCULATIONS FOR DERMAL CONTACT WITH, INCIDENTAL INGESTION OF, AND INHALATION OF VAPORS IN ON-SITE SURFICIAL SOIL

OCCUPATIONAL MAINTENANCE WORKER POPULATION

Constituent	C CS (mg/kg)	NC CS (mg/kg)	CF (kg/mg)	SA (cm²/day)	AF (mg/cm²)	ABS (unitless)	EF (day/yr)	ED (yr)	BW (kg)	NC AT (days)	C AT (days)	IR (mg/day)	FI (unitless)	Oral Slope Factor (SF) c 1/(mg/kg-day)	Oral Reference Dose (RfD) c (mg/kg-day)	IRinh (m³/hr)	ET (hr/day)	VF (m³/kg)	Inhalation Slope Factor (SF) c 1/(mg/kg-day)	Inhalation Reference Dose (RfD) c (mg/kg-day)	Target Risk (TR)	Target Hazard Index (THI)
Acetone	--	4.7E+05	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	--	0.1	0.833	4	-	--	--	1.0E-06	1
2-Butanone	--	9.0E+03	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	--	0.05	0.833	4	210	--	0.29	1.0E-06	1
Chloroform	8.5E-01	4.7E+04	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	0.0061	0.01	0.833	4	160	0.081	--	1.0E-06	1
Chloromethane	3.5E+00	--	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	0.013	--	0.833	4	51	0.0063	--	1.0E-06	1
1,2-Dichloroethene (cis)	--	4.7E+04	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	--	0.01	0.833	4	--	--	--	1.0E-06	1
1,2-Dichloroethene (trans)	--	9.5E+04	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	--	0.02	0.833	4	--	--	--	1.0E-06	1
Ethyl benzene	--	7.9E+03	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	--	0.1	0.833	4	180	--	0.29	1.0E-06	1
2-Hexanone	--	--	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	--	--	0.833	4	--	--	--	1.0E-06	1
Methylene chloride	2.0E+01	9.4E+03	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	0.0075	0.06	0.833	4	74	0.0016	0.86	1.0E-06	1
2-Methylnaphthalene	--	--	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	--	--	0.833	4	--	--	--	1.0E-06	1
4-Methyl-2-pentanone	--	2.4E+05	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	--	0.05	0.833	4	--	--	--	1.0E-06	1
Naphthalene	--	--	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	--	--	0.833	4	--	--	--	1.0E-06	1
1,1,2,2-Tetrachloroethane	1.1E+00	--	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	0.2	--	0.833	4	500	0.2	--	1.0E-06	1
Tetrachloroethene	--	4.7E+04	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	--	0.01	0.833	4	--	--	--	1.0E-06	1
Toluene	--	1.7E+03	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	--	0.2	0.833	4	100	--	0.11	1.0E-06	1
1,1,2-Trichloroethane	2.5E+00	1.9E+04	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	0.057	0.004	0.833	4	330	0.056	--	1.0E-06	1
Trichloroethene	7.8E+00	--	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	0.011	--	0.833	4	110	0.006	--	1.0E-06	1
Xylene (total)	--	9.5E+06	1.0E-06	5800	1.0	0.01	50	25	70	9125	25550	50	1.0	--	2	0.833	4	--	--	--	1.0E-06	1

APPENDIX E

DESCRIPTION OF FIELD AND LABORATORY TESTS FOR THE TREATABILITY STUDY

DESCRIPTION OF FIELD AND LABORATORY TESTS

FIELD TESTS

Clean soils were obtained from near the zero line of soil TCE concentrations using a garden shovel. Five gallon buckets of soils were collected from three intervals; 2 inches to 10 inches, 10 inches to 20 inches, and 20 inches to 25 inches. Increased soil moisture content was observed that the soils with depth. After the hole had been open for several minutes, water was observed to be seeping in from a depth of approximately 18 inches.

The soils from the upper interval were used to make an initial evaluation of blending characteristics. These soils were moderately damp, dark brown sand and silts and contained a few small roots which were pulled from the soil prior to blending.

The blending tests were conducted by adding ten scoops of soil to a plastic bin, 22 inches by 16 inches, by 6 inches deep. The soils were stirred and then the amendment added in the amounts shown in Table E-1. The soils and sand/gravel were mixed using a hand tool resembling a garden rake. Approximately twenty strokes were used to accomplish the blending. After blending the appearance and behavior of the blend were recorded. Where appropriate, the next blend was created from the previous blend by adding and stirring in more gravel or sand.

Nine blends were tested using the upper six inches of soil. Two tests were conducted using an equal blend of the three soil intervals. The ratio of sand and gravel deemed best from the first nine tests, 10:2:1 of soil:sand:gravel, was used. A second blend was created by adding more sand to the 10:2:1 blend to give a 10:4:1 mixture.

Soil samples were then collected from the area indicated as having the highest levels of contamination. Small soil samples (200-300 gm) were placed in ziplock bags. The vapor phase within the sealed bags was screened after approximately fifteen minutes using an OVA meter. Samples from the two intervals, 6-12 inches and 12-18, inches both exceeded the upper limit of the meter (1,000 PPM) in air space analysis.

Soils from both intervals were mixed in equal amounts in the plastic bins. Approximately 20 strokes were used to mix the soils. A sample was collected for analysis. The soils were then blended with sand and gravel to produce a 10:2:1 blend. The soil blend was sampled

TABLE E-1

EVALUATION OF DILUTION REQUIREMENTS/EFFECTS FOR ROCKWELL GRENADA CLEAN SHALLOW SOILS[a,b]

Batch Number	Ratio of Soil:Sand:Gravel	Rating[c]	Comments
0	10:0:0	1	Soils sticks and clumps. not easily worked
1	10:2:0	2	Little change. still packs and sticks together
2	10:4:0	3	Less tendency to pack together
3	10:4:2	8	Large improvement easily mixed-little clumping
4	10:0:2	3	Still forms clumps with some separation
5	10:2:2	7	Sand reduces clumping easily mixed, better than sand or gravel alone
6	10:2:2:(1-gypsum)	7	Gypsum had no discernible effect
7	10:1:1	6	Better than 10:2:0 or 10:0:2. Mixture of sand and gravel helps
8	10:1:2	7	Additional gravel over 7 has marginal benefit
9	10:2:1	8	Better than 10:1:2 nearly the same as 10:4:2. Better than 10:2:2 - maybe mixing order important.
10	(10-soil blend):2:1		Soil blend was sloppy wet. Saturated soils very hard to mix. Blend hard to work. Improves greatly with a little drying (1-2 hrs on a cool/sunless day)
11	(10-soil blend):4:1		Consistency of a heavy mortar. Handling characteristics improved after one hour air drying. May be a 5 or 6 rating.

[a]Batches 1-9 used soils from 2"-10" interval.
[b]Batches 10 & 11 used a 4:3:3 blend of soils from 2"-10", 10"-20", and 20"-24".
[c]Relative rating with 0 being plastic behavior and 10 being friable with little clumping potential.

for analysis. The remaining soil was then placed in four 20 inch long, four inch diameter PVC pipes and the ends of the pipe capped and tapped.

A second mixture of contaminated soils was prepared using equal amounts of soils from the two intervals. The soils were stirred 20 strokes to mix the soils and an additional 20 strokes to simulate losses during blending. The soils were sample in duplicate. The bulk of the soils were transferred to two more PVC pipes.

OBSERVATIONS

The soils, as removed from the ground, had a significant tendency to clump. The soils became more difficult to work with increased depth from the ground surface. The soils collected beneath the point where water seepage into the hole was observed were difficult to stir and tended to act as one amorphous mass. The soils above the seepage line responded to the addition of sand and/or gravel. Sand appeared to coat the soils and greatly reduce the tendency to clump. Gravel alone tended to be incorporated into the clumps but provided some separation. When sand was added first followed by gravel, the amount of clumping was greatly reduced and the gravel provided separation. As a result, the soils treated with a mixture of sand and gravel had reasonable handling characteristics.

Based on the observations made during this phase a mixture of 10:2:1 of soil to sand to gravel was found to provide suitable soil handling characteristics and minimal dilution. It appeared that adding the sand before the gravel was preferable to adding the gravel first. The soils beneath the seep line require some drying before blending. The blend of soils from all three depths was hard to work and blend, but became much more workable after sitting one hour on a piece of plastic (the weather was overcast and cool with minimal wind).

LABORATORY TESTS

The two capped pipes containing unamended soils and two of the capped pipes containing the soil/sand/gravel blends were fitted with threaded 1/4 inch pipe. An air line was manifolded into four lines, each fitted with a rotameter flow control. Air was passed through each column and discharged into a fume hood. The air flow through each column was maintained between 9 and 11 cc/min. This corresponds to approximately 3.3 reactor

volumes per day or 6.6 pore volumes per day assuming a porosity of 0.5. The pipes were rotated on their long axis each day to minimize effects from any channeling of air flow.

After 16 and 33 days, the PVC reactor pipes were sampled by transferring the contents to a plastic bin, stirring the samples and collecting small portions of soils from several locations, and placing the soils in a 120 mL VOA jar to form a composited sample. Each sample was collected in duplicate in case abnormal results required further confirmation. At each time point samples were collected from two pipes containing unamended sample and two pipes containing sand/gravel amended soils that were subjected to air flow. Additional samples of amended soils were obtained from a pipe containing amended soils but which remained capped except during sampling events.

Soils from one of the pipes containing the amended soils were placed in an open tared pyrex dish, weighed, and placed in a fume hood. The soils were stirred daily. The weight of the soils and dish was determined on several occasions to measure the weight loss due to drying of the soils. Duplicate samples were collected at days 16 and 33.

It was observed during the first sampling that as the unamended soils were removed from the PVC pipe, that the soils tended to retain the shape of the pipe and were somewhat difficult to remove. By contrast the blended soils were removed with less effort and easily broke apart while being removed from the pipe.

During the second sampling there appeared to be little change in moisture (maybe a small decrease in moisture) level or handling characteristics from that observed during the first sampling.

The soils that were placed in the open dish were very hard and dry after 16 days. During the first eight hours in the hood, the soils lost 6.5 percent of their weight, presumably as moisture. After 16 days the soils had lost 18 percent of the original weight.

APPENDIX F

LABORATORY ANALYTICAL REPORTS FROM THE TREATABILITY STUDY

CLIENT: ROCKWELL INTERNATIONAL #9124.02

DATE SAMPLED: 3/17/93
DATE RECEIVED: 3/18/93
DATE REPORTED: 4/7/93

ECKENFELDER SAMPLE NUMBER			1431	1432	1433	1434	
CLIENT SAMPLE DESCRIPTION			D-1	D-1 BLEND	D-2	DUPLICATE	METHOD BLANK
VOLATILE ORGANICS BY USEPA METHOD 8240	MDL	EQL	CONC	CONC	CONC	CONC	CONC
ACETONE	0.63	6.3	U	U	U	U	U
BENZENE	0.13	1.3	U	U	U	U	U
BROMODICHLOROMETHANE	0.13	1.3	U	U	U	U	U
BROMOFORM	0.13	1.3	U	U	U	U	U
BROMOMETHANE	0.25	2.5	U	U	U	U	U
2-BUTANONE	1.25	13	U	U	U	U	U
CARBON DISULFIDE	0.25	2.5	U	U	U	U	U
CARBON TETRACHLORIDE	0.13	1.3	U	U	U	U	U
CHLOROBENZENE	0.13	1.3	U	U	U	U	U
CHLOROETHANE	0.25	2.5	U	U	U	U	U
2-CHLOROETHYL VINYL ETHER	0.13	1.3	U	U	U	U	U
CHLOROFORM	0.13	1.3	U	U	U	U	U
CHLOROMETHANE	0.25	2.5	U	U	U	U	U
DIBROMOCHLOROMETHANE	0.13	1.3	U	U	U	U	U
1,2-DICHLOROBENZENE	0.13	1.3	U	U	U	U	U
1,3-DICHLOROBENZENE	0.13	1.3	U	U	U	U	U
1,4-DICHLOROBENZENE	0.13	1.3	U	U	U	U	U
1,1-DICHLOROETHANE	0.13	1.3	U	U	U	U	U
1,2-DICHLOROETHANE	0.13	1.3	U	U	U	U	U
1,1-DICHLOROETHENE	0.25	2.5	U	U	U	U	U
1,2-DICHLOROETHENE(TOTAL)	0.13	1.3	U	U	U	U	U
1,2-DICHLOROPROPANE	0.13	1.3	U	U	U	U	U
1,3-DICHLOROPROPENE (TOTAL)	0.13	1.3	U	U	U	U	U
ETHYLBENZENE	0.13	1.3	U	U	U	U	U
2-HEXANONE	0.25	2.5	U	U	U	U	U
4-METHYL-2-PENTANONE	0.25	2.5	U	U	U	U	U
METHYLENE CHLORIDE	0.25	2.5	U	0.4 JB	0.4 JB	0.4 JB	0.4 JB
STYRENE	0.13	1.3	U	U	U	U	U
1,1,2,2-TETRACHLOROETHANE	0.13	1.3	U	U	U	U	U
TETRACHLOROETHENE	0.13	1.3	U	U	U	U	U

ALL RESULTS EXPRESSED IN MILLIGRAMS/KILOGRAM (WET) UNLESS OTHERWISE NOTED.

SEE ATTACHED PAGE FOR DEFINITIONS OF TERMS AND QUALIFIERS.

ALL SAMPLES WERE EXTRACTED AND/OR ANALYZED WITHIN USEPA HOLDING TIMES UNLESS OTHERWISE NOTED.

227 French Landing Drive
Nashville, Tennessee 37228
615.255.2288
FAX 615.256.8332

CLIENT: ROCKWELL INTERNATIONAL #9124.02
DATE SAMPLED: 4/2/93
DATE RECEIVED: 4/2/93
DATE REPORTED: 4/20/93

ECKENFELDER SAMPLE NUMBER			1787	1788	1789	1790	1791	1792	
CLIENT SAMPLE DESCRIPTION			D-2-F1	D-1-F2	D-1-F3	D-2 F4	D-1-H	D-1-C	METHOD BLANK
VOLATILE ORGANICS BY USEPA METHOD 8240	MDL	EQL	CONC	CONC	CONC	CONC	CONC	CONC	CONC
ACETONE	0.63	6.3	U	U	U	U	U	U	U
BENZENE	0.13	1.3	U	U	U	U	U	U	U
BROMODICHLOROMETHANE	0.13	1.3	U	U	U	U	U	U	U
BROMOFORM	0.13	1.3	U	U	U	U	U	U	U
BROMOMETHANE	0.25	2.5	U	U	U	U	U	U	U
2-BUTANONE	1.3	13	U	U	U	U	U	U	U
CARBON DISULFIDE	0.25	2.5	U	U	U	U	U	U	U
CARBON TETRACHLORIDE	0.13	1.3	U	U	U	U	U	U	U
CHLOROBENZENE	0.13	1.3	U	U	U	U	U	U	U
CHLOROETHANE	0.25	2.5	U	U	U	U	U	U	U
2-CHLOROETHYL VINYL ETHER	0.13	1.3	U	U	U	U	U	U	U
CHLOROFORM	0.13	1.3	U	U	U	U	U	U	U
CHLOROMETHANE	0.25	2.5	U	U	U	U	U	U	U
DIBROMOCHLOROMETHANE	0.13	1.3	U	U	U	U	U	U	U
1,2-DICHLOROBENZENE	0.13	1.3	U	U	U	U	U	U	U
1,3-DICHLOROBENZENE	0.13	1.3	U	U	U	U	U	U	U
1,4-DICHLOROBENZENE	0.13	1.3	U	U	U	U	U	U	U
1,1-DICHLOROETHANE	0.13	1.3	U	U	U	U	U	U	U
1,2-DICHLOROETHANE	0.13	1.3	U	U	U	U	U	U	U
1,1-DICHLOROETHENE	0.25	2.5	U	U	U	U	U	U	U
1,2-DICHLOROETHENE(TOTAL)	0.13	1.3	U	U	U	U	U	U	U
1,2-DICHLOROPROPANE	0.13	1.3	U	U	U	U	U	U	U
1,3-DICHLOROPROPENE(TOTAL)	0.13	1.3	U	U	U	U	U	U	U
ETHYLBENZENE	0.13	1.3	U	U	U	U	U	U	U
2-HEXANONE	0.25	2.5	U	U	U	U	U	U	U
4-METHYL-2-PENTANONE	0.25	2.5	U	U	U	U	U	U	U
METHYLENE CHLORIDE	0.25	2.5	U	U	0.9 J	0.9 J	0.1 J	0.9 J	U
STYRENE	0.13	1.3	U	U	U	U	U	U	U

ALL RESULTS EXPRESSED IN MILLIGRAMS/KILOGRAM (WET) UNLESS OTHERWISE NOTED.

SEE ATTACHED PAGE FOR DEFINITIONS OF TERMS AND QUALIFIERS.

ALL SAMPLES WERE EXTRACTED AND/OR ANALYZED WITHIN USEPA HOLDING TIMES UNLESS OTHERWISE NOTED.

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ECKENFELDER INC.

CLIENT: ROCKWELL INTERNATIONAL #9124.02

DATE SAMPLED: 4/2/93
DATE RECEIVED: 4/2/93
DATE REPORTED: 4/21/93

ECKENFELDER SAMPLE NUMBER			1787	1787D	1788*	1788D	1789	1789D
CLIENT SAMPLE DESCRIPTION			D-2-F1	D-2-F1	D-1-F2	D-1-F2	D-1-F3	D-1-F3
VOLATILE ORGANICS BY USEPA METHOD 8240	MDL	EQL	CONC	10X (1) CONC	CONC	10X (1) CONC	CONC	5X (1) CONC
ACETONE	5.0	50	U	U	U	U	U	U
BENZENE	1.0	10	U	U	U	U	U	U
BROMODICHLOROMETHANE	1.0	10	U	U	U	U	U	U
BROMOFORM	1.0	10	U	U	U	U	U	U
BROMOMETHANE	2.0	20	U	U	U	U	U	U
2-BUTANONE	10	100	U	U	U	U	U	U
CARBON DISULFIDE	2.0	20	U	U	U	U	U	U
CARBON TETRACHLORIDE	1.0	10	U	U	U	U	U	U
CHLOROBENZENE	1.0	10	U	U	U	U	U	U
CHLOROETHANE	2.0	20	U	U	U	U	U	U
2-CHLOROETHYL VINYL ETHER	1.0	10	U	U	U	U	U	U
CHLOROFORM	1.0	10	U	U	U	U	U	U
CHLOROMETHANE	2.0	20	U	U	U	U	U	U
DIBROMOCHLOROMETHANE	1.0	10	U	U	U	U	U	U
1,2-DICHLOROBENZENE	1.0	10	U	U	U	U	U	U
1,3-DICHLOROBENZENE	1.0	10	U	U	U	U	U	U
1,4-DICHLOROBENZENE	1.0	10	U	U	U	U	U	U
1,1-DICHLOROETHANE	1.0	10	U	U	U	U	U	U
1,2-DICHLOROETHANE	1.0	10	U	U	U	U	U	U
1,1-DICHLOROETHENE	2.0	20	U	U	U	U	U	U
1,2-DICHLOROETHENE(TOTAL)	1.0	10	U	U	U	U	U	U
1,2-DICHLOROPROPANE	1.0	10	U	U	U	U	U	U
1,3-DICHLOROPROPENE(TOTAL)	1.0	10	U	U	U	U	U	U
ETHYLBENZENE	1.0	10	U	U	U	U	U	U
2-HEXANONE	2.0	20	U	U	U	U	U	U
4-METHYL-2-PENTANONE	2.0	20	U	U	U	U	U	U
METHYLENE CHLORIDE	2.0	20	U	U	U	U	U	U
STYRENE	1.0	10	U	U	U	U	U	U

ALL RESULTS EXPRESSED IN MICROGRAMS/LITER UNLESS OTHERWISE NOTED.

SEE ATTACHED PAGE FOR DEFINITIONS OF TERMS AND QUALIFIERS.

ALL SAMPLES WERE EXTRACTED AND/OR ANALYZED WITHIN USEPA HOLDING TIMES UNLESS OTHERWISE NOTED.

*** = SOME ASPECT OF QUALITY CONTROL WAS NOT WITHIN ACCEPTABLE USEPA HOLDING TIMES UNLESS OTHERWISE NOTED.**

(1) = SAMPLES WERE DILUTED BY THE NUMERICAL VALUE DISPLAYED, DETECTION LIMITS SHOULD INCREASE BY THE SAME FACTOR.

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ECKENFELDER INC.

CLIENT: ROCKWELL INTERNATIONAL #9124.02
DATE SAMPLED: 4/2/93
DATE RECEIVED: 4/2/93
DATE REPORTED: 4/21/93

ECKENFELDER SAMPLE NUMBER			1787	1787D	1788*	1788D	1789	1789D
CLIENT SAMPLE DESCRIPTION			D-2-F1	D-2-F1	D-1-F2	D-1-F2	D-1-F3	D-1-F3
VOLATILE ORGANICS BY USEPA METHOD 8240 CONT'D	MDL	EQL	CONC	10X (1) CONC	CONC	10X (1) CONC	CONC	5X (1) CONC
1,1,2,2-TETRACHLOROETHANE	1.0	10	U	U	U	U	U	U
TETRACHLOROETHENE	1.0	10	U	U	U	U	U	U
TOLUENE	1.0	10	U	U	U	U	U	U
1,1,1-TRICHLOROETHANE	1.0	10	U	U	U	U	U	U
1,1,2-TRICHLOROETHANE	1.0	10	U	U	U	U	U	U
TRICHLOROETHENE	1.0	10	140	130 D	110	100 D	62	110 D
TRICHLOROFLUOROMETHANE	2.0	20	U	U	U	U	U	U
VINYL ACETATE	1.0	10	U	U	U	U	U	U
VINYL CHLORIDE	2.0	20	U	U	U	U	U	U
XYLENE(TOTAL)	1.0	10	U	U	U	U	U	U

UNLESS OTHERWISE NOTED.

SEE ATTACHED PAGE FOR DEFINITIONS OF TERMS AND QUALIFIERS.

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* = SOME ASPECT OF QUALITY CONTROL WAS NOT WITHIN ACCEPTABLE USEPA HOLDING TIMES UNLESS OTHERWISE NOTED.

(1) = SAMPLES WERE DILUTED BY THE NUMERICAL VALUE DISPLAYED, DETECTION LIMITS SHOULD INCREASE BY THE SAME FACTOR.

ECKENFELDER INC.

CLIENT: ROCKWELL INTERNATIONAL #9124.02
DATE SAMPLED: 4/2/93
DATE RECEIVED: 4/2/93
DATE REPORTED: 4/21/93

ECKENFELDER SAMPLE NUMBER			1790D	1791*	1791D	1792D	
CLIENT SAMPLE DESCRIPTION			D-2 F4	D-1-H	D-1-H	D-1-C	METHOD BLANK
VOLATILE ORGANICS BY USEPA METHOD 8240	MDL	EQL	10X (1) CONC	CONC	5X (1) CONC	10X (1) CONC	CONC
ACETONE	5.0	50	U	75	100 JD	U	U
BENZENE	1.0	10	U	U	U	U	U
BROMODICHLOROMETHANE	1.0	10	U	U	U	U	U
BROMOFORM	1.0	10	U	U	U	U	U
BROMOMETHANE	2.0	20	U	U	U	U	U
2-BUTANONE	10	100	U	U	U	U	U
CARBON DISULFIDE	2.0	20	U	U	U	U	U
CARBON TETRACHLORIDE	1.0	10	U	U	U	U	U
CHLOROBENZENE	1.0	10	U	U	U	U	U
CHLOROETHANE	2.0	20	U	U	U	U	U
2-CHLOROETHYL VINYL ETHER	1.0	10	U	U	U	U	U
CHLOROFORM	1.0	10	U	U	U	U	U
CHLOROMETHANE	2.0	20	U	U	U	U	U
DIBROMOCHLOROMETHANE	1.0	10	U	U	U	U	U
1,2-DICHLOROBENZENE	1.0	10	U	U	U	U	U
1,3-DICHLOROBENZENE	1.0	10	U	U	U	U	U
1,4-DICHLOROBENZENE	1.0	10	U	U	U	U	U
1,1-DICHLOROETHANE	1.0	10	U	U	U	U	U
1,2-DICHLOROETHANE	1.0	10	U	U	U	U	U
1,1-DICHLOROETHENE	2.0	20	U	U	U	U	U
1,2-DICHLOROETHENE(TOTAL)	1.0	10	U	U	U	U	U
1,2-DICHLOROPROPANE	1.0	10	U	U	U	U	U
1,3-DICHLOROPROPENE(TOTAL)	1.0	10	U	U	U	U	U
ETHYLBENZENE	1.0	10	U	U	U	U	U
2-HEXANONE	2.0	20	U	U	U	U	U
4-METHYL-2-PENTANONE	2.0	20	U	14 J	U	U	U
METHYLENE CHLORIDE	2.0	20	U	U	U	U	U
STYRENE	1.0	10	U	U	U	U	U

ALL RESULTS EXPRESSED IN MICROGRAMS/LITER UNLESS OTHERWISE NOTED.

SEE ATTACHED PAGE FOR DEFINITIONS OF TERMS AND QUALIFIERS.

ALL SAMPLES WERE EXTRACTED AND/OR ANALYZED WITHIN USEPA HOLDING TIMES UNLESS OTHERWISE NOTED.

*** = SOME ASPECT OF QUALITY CONTROL WAS NOT WITHIN ACCEPTABLE USEPA HOLDING TIMES UNLESS OTHERWISE NOTED.**

(1) = SAMPLES WERE DILUTED BY THE NUMERICAL VALUE DISPLAYED, DETECTION LIMITS SHOULD INCREASE BY THE SAME FACTOR.

ECKENFELDER INC.

CLIENT: ROCKWELL INTERNATIONAL #9124.02
DATE SAMPLED: 4/2/93
DATE RECEIVED: 4/2/93
DATE REPORTED: 4/21/93

ECKENFELDER SAMPLE NUMBER			1790D	1791*	1791D	1792D	
CLIENT SAMPLE DESCRIPTION			D-2 F4	D-1-H	D-1-H	D-1-C	METHOD BLANK
VOLATILE ORGANICS BY USEPA METHOD 8240 CONT'D	MDL	EQL	10X (1) CONC	CONC	5X (1) CONC	10X (1) CONC	CONC
1,1,2,2-TETRACHLOROETHANE	1.0	10	U	U	U	U	U
TETRACHLOROETHENE	1.0	10	U	U	U	U	U
TOLUENE	1.0	10	U	U	U	U	U
1,1,1-TRICHLOROETHANE	1.0	10	U	U	U	U	U
1,1,2-TRICHLOROETHANE	1.0	10	U	U	U	U	U
TRICHLOROETHENE	1.0	10	950 D	32	57 JD	420 D	U
TRICHLOROFLUOROMETHANE	2.0	20	U	U	U	U	U
VINYL ACETATE	1.0	10	U	U	U	U	U
VINYL CHLORIDE	2.0	20	U	U	U	U	U
XYLENE(TOTAL)	1.0	10	U	U	U	U	U

UNLESS OTHERWISE NOTED.

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*** = SOME ASPECT OF QUALITY CONTROL WAS NOT WITHIN ACCEPTABLE USEPA HOLDING TIMES UNLESS OTHERWISE NOTED.**

(1) = SAMPLES WERE DILUTED BY THE NUMERICAL VALUE DISPLAYED, DETECTION LIMITS SHOULD INCREASE BY THE SAME FACTOR.

ECKENFELDER INC.

D. Rick Davis

D. RICK DAVIS
VICE PRESIDENT/ANALYTICAL & TESTING SERVICES

ECKENFELDER INC.

CLIENT: ROCKWELL INTERNATIONAL #9124.02

DATE SAMPLED: 4/20/93
DATE RECEIVED: 4/20/93
DATE REPORTED: 5/6/93

ECKENFELDER SAMPLE NUMBER			2137	2138	2139	2140	2141
CLIENT SAMPLE DESCRIPTION			D2F1	D2F2	D1F3	D2F4	D1C
VOLATILE ORGANICS BY USEPA METHOD 8240	MDL	EQL	CONC	CONC	CONC	CONC	CONC
TRICHLOROETHENE	0.13	1.3	2.2	0.26 J	0.23 J	0.75 J	2.6

ALL RESULTS EXPRESSED IN MILLIGRAMS/KILOGRAM (WET) UNLESS OTHERWISE NOTED.

ALL SAMPLES WERE EXTRACTED AND/OR ANALYZED WITHIN USEPA HOLDING TIMES UNLESS OTHERWISE NOTED.

SEE ATTACHED PAGE FOR DEFINITIONS OF TERMS AND QUALIFIERS.

227 French Landing Drive
Nashville, Tennessee 37228
615.255.2288
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ANALYTICAL REPORT TERMS AND QUALIFIERS

MDL: The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The MDL is determined from analysis of a sample containing the analyte in a given matrix.

EQL: The estimated quantitation limit (EQL) is defined as the estimated concentration above which quantitative results can be obtained with a specific degree of confidence. ECKENFELDER INC. defines the EQL to be ten times the MDL.

U: The presence of a "U" indicates that the compound was analyzed for but was not detected.

B: The presence of a "B" to the right of an analytical value indicates that this compound was also detected in the method blank and the data should be interpreted with caution. One should consider the possibility that the correct sample result might be less than the reported result and, perhaps, zero.

D: When a sample (or sample extract) is rerun diluted because one of the compound concentrations exceeded the highest concentration range for the standard curve, all of the values obtained in the dilution run will be flagged with a "D".

E: The concentration for any compound found which exceeds the highest concentration level on the standard curve for that compound will be flagged with an "E". Usually the sample will be rerun at a dilution to quantitate the flagged compound.

J: The presence of a "J" to the right of an analytical result indicates that the reported result is estimated. The mass spectral data pass the identification criteria showing that the compound is present, but the calculated result is less than the PQL. One should feel confident that the result is greater than zero and less than the PQL. The "J" qualifier may also be used to indicate that some aspect of quality control was not within acceptable limits.